WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 9, Issue 3, 1573-1584. Review Article ISSN 2277– 7105

HYPERLIPIDEMIA: A CAUSATIVE FACTOR OF *DHAMANIPRATICHAYA* W.S.R. TO ATHEROSCLEROSIS

Dr. Kanchan D. Raut*[1] and Dr. Ninad Sathe[2]

*[1]MD Scholar, Rasashastra and Bhaishajya Kalpana Department.

[2]Professor, Rasashastra and Bhaishajya Kalpana Department.

Dr.G.D.Pol Foundation's Ayurvedic Medical College and P.G. Institute, Kharghar, New Mumbai.

Article Received on
18 Jan. 2020,

Revised on 07 Feb. 2020,
Accepted on 28 Feb. 2020,

DOI: 10.20959/wjpr20203-16990

***Corresponding Author**
Dr. Kanchan D. Raut
MD Scholar, Rasashastra and Bhaishajya Kalpana Department, Dr.G.D.Pol Foundation's Ayurvedic Medical College and P.G. Institute, Kharghar, New Mumbai.

ABSTRACT

With the evolution in human society, occurring lifestyle diseases are more related with heart disease, stroke, obesity, type II diabetes and diseases associated with smoking, alcohol and drug abuse. Hyperlipidemia is a metabolic syndrome characterized by diverse lipid profiles like hypercholesterolemia, hypertriglyceridemia, and familial combined hyperlipidemia. There is a well established association between lipid concentrations and the risk of CVD. Globally, a third of ischemic heart disease is attributable to high cholesterol. This change in the vessel wall is referred as *dhamanipratichaya* (atherosclerosis). As per involvement of *Dosha-dushya* the disease can be considered among '*Santarpana Janya Vikaras'*. Ayurveda has mentioned several medicines which are mentioned as *lekhaniya*, doing the scrapping action of excessive fat. Also various researches carried out on ayurvedic medicines have proved promising effect in lowering the low density lipoprotein, and certain medicines even have helped in increasing high density lipoprotein. This article gives us a review about modern concept of hyperlipidemia and its correlation with *dhamanipratichaya*, along with its treatment.

KEYWORDS: Hyperlipidemia, cholesterol, *dhamanipratichaya.*

INTRODUCTION

Hyperlipidemia is a medical condition characterized by an increase in one or more of the plasma lipids, including triglycerides, cholesterol, cholesterol esters, phospholipids and or

plasma lipoproteins including very low-density lipoprotein and low-density lipoprotein along with reduced high-density lipoprotein levels. Hypercholesterolemia and hypertriglyceridemia are the main cause of atherosclerosis which is strongly related to ischemic heart disease (IHD).[1]

Hyperlipoproteinemia is the lipid disturbance of major relevance clinically because of its association with an increased risk of atherosclerotic cardiovascular disease. Multiple epidemiologic studies have demonstrated that increased levels of plasma total cholesterol and low-density lipoproteins are strongly and directly related to a greater incidence of coronary heart disease. Elevated plasma triglycerides and very-low-density lipoproteins are directly associated with the risk of atherosclerotic heart disease, although not as independent risk factors. In contrast, high levels of high-density lipoprotein cholesterol have been found to be a protective factor for the development of that disease, so that decreased levels constitute a risk factor.[2]

In Ayurveda, Hyperlipidemia is described under various nomenclatures such as *Medodushti, Atisnigdhadhatu, Dushit kleda* etc. There is no precise term for hyperlipidemia in the Ayurvedic classics. Literature shows that scholars have tried to use distinct nomenclature for hyperlipidemia, e.g., *Rasagata Sneha Vriddhi* (increase in lipids in plasma), *Rasa Raktagata Sneha Vriddhi* (increase in the lipids in plasma and blood), *Medovriddhi* (generalized lipid increase), *Medoroga* or *Medodosha* (obesity), *Aama Medo Dhatu* (abnormally formed adipose tissue). A detailed study of hyperlipidemia reveals its similarity to *Asthayi Medo Dhatu Vriddhi* (abnormal increase in circulating lipids) with regard to the pathophysiology. This excessively increased circulating lipid is *aama* in nature, resulting in further complications.[3]

Hyperlipidemia is a form of *Kaphavikara* specifically may be *Medodushti* in the form of *AbaddhaMeda*.[4] As per involvement of *Dosha-dushya* the disease can be considered among '*SantarpanaJanyaVikaras'*. The major pathological factors behind the disease basically include *Kapha vriddhi, Jathargni dushti, Medo dhatvagnimandya & Avarana* of *Vata* which all finally leads to *Amarupa Medovridhi*.[4] It is worth mentioning here that this morbid accumulation of *kapha* and *medas* with the vessels of rasa and *raktadhatu* is termed as *shonitabhishyandana (hyperlipidemia).* It is said that *dhamani pratichaya* and *margavarana* are the sequel of this *shonitabhishyandana*.[5]

CONCEPT OF HYPERLIPIDEMIA

- **Lipoproteins**

Lipoproteins are macro molecules aggregate composed of lipids and proteins. This structure facilitates lipids compatibility with the aqueous body fluids. Chylomicrons (CM), very low density lipoproteins (VLDL), low-density lipoproteins(LDL), intermediate-density lipoproteins (IDL) and high-density lipoproteins (HDL) are the five main classes of lipoproteins present in plasma. These classes are heterogeneous and have different composition, size, and density.[6][1]

Table no 1: Normal Range of the lipoproteins.[7]

Variables assessed (mg/dl)	Normal Range
Serum cholesterol	<200 mg/dl
Serum triglyceride (TG)	<150 mg/dl
Serum HDL	>60 mg/dl
Serum LDL	<130 mg/dl
Serum VLDL	<30 mg/dl

- **Cholesterol**

Cholesterol is a waxy substance present in blood plasma and is a primary component of the membrane that surrounds each human cell. In its pure state it is a white, crystalline substance being odorless and tasteless. Cholesterol It is the starting material or an intermediate compound from which the body synthesizes bile acids, steroid hormones, and vitamin D. Cholesterol circulates in the bloodstream and is synthesized by the liver and several other organs. Dietary food also contributes in cholesterol formation.[8]

PATHOGENESIS OF HYPERLIPIDEMIA

During the early stages of hyperlipidemia, blood monocytes and platelets attach to a vessel wall at the sites of endothelial damage. The release of the mediators such as platelet derived growth factors leads to a proliferation of smooth cells in the intimal and medial lining of the vessel, collagen synthesis, cholesterol uptake and the beginning of the hyperlipidemic plaque results. Cholesterol deposits and other fatty substances circulating in the blood accumulate in the interior walls of the blood vessels. These fatty deposits build up, thicken, and become calcified, eventually converting the vessel walls to scar tissue. Ruptured plaque results in the acute syndromes of unstable angina, myocardial infarction and sudden cardiac death.[8][9]

CLASSIFICATION OF HYPERLIPIDEMIA

i) Primary hyperlipidemia - is familial and can occur due to single gene defect (monogenic), multiple gene defects (polygenic), dietary and physical activity related causes, polygenic or multifactorial.

ii) Secondary hyperlipidemia - is acquired because it is caused by another disorder like Diabetes, Myxoedema, Nephritic Syndrome, Chronic Alcoholism, Drugs like corticosteroids, beta blockers and oral contraceptives. HIV is an important consideration both because the infection and the use of protease inhibitors can contribute to lipid abnormalities.[1][9][10][11]

On the basis of lipid type

- **Hypercholesterolemia-** In this the level of cholesterol is elevated.
- **Hypertriglyceridemia-** It is defined as an elevated level of triglycerides.[9]

DRUG THERAPY USED IN DIFFERENT TYPES OF HYPERLIPDEMIA

Hypercholesterolaemia: The statins, pravastatin and simvastatin are first choice. Alternatives are bile acid resins such as cholecystyramine.

Mixed hyperlipidaemia: The statins or alternatively fibrates such as (elevated cholesterol and TG) gemfibrozil.

Hypertriglyceridaemia: Fibrates such as gemfibrozil are used as first line therapy, (elevated TG) alternatively use the statins.[12]

Side effects

Statins are said to have the adverse effects of depression, anxiety, indigestion, headache, rashes, gastrointestinal symptoms, alopecia, memory loss, dyspenea. Recent clinical trials showed that statin use has been linked to an increase in type 2 diabetes.[1][9]

CONCEPT OF LIPIDS IN AYURVEDA

- **Formation of *Meda dhatu***

According to *Charaka*, the *meda dhatu* is produced from *mansa dhatu*. During *paka* of *mansa dhatu*, from its *Prasad bhag, medodhatu* formation and *mansa dhatu poshan* occurs, and *medodhatu* is formed. [13]

There are three theories about the modes of *dhatu* formation (Nourishment)

- *Ksheer-dadhi-nyaya.*
- *Kedar-kulya-nyaya.*
- *Khale-kapot-nyaya.*[14]

- ***Sthana* and *Swarupa* of *Meda dhatu***

Human body consists of many tissues which are rich in lipids having *Sneha* (oiliness) as common feature. They are *Medo Dhatu, Vasa* and *Majja Dhatu*. Having *Snehatwa* as common feature, all the three are different in their site and function.

There are two types of *Medo Dhatu*

1. *Poshaka* (Nutrients) – it is mobile in nature which is circulated in the whole body along with the *Rasa-Rakta Dhatu*, giving nutrition to *Poshya Medo Dhatu*. It can be correlated with lipids along with the cholesterol, being circulated with the blood.

2. Poshya(Nourish)- it is immobile in nature, and stored in *Medodhara kala* i.e. *Udara, Sphika, Stana, Gala, etc. and Vasa (Mamsavaha sneha).* It can be correlated with adipose tissues / fat.[14][15]

- ***Pramana* of *Meda dhatu***

The total quantity of *Meda* is two *Anjali* and the *Vasa* (Muscle's fat) is three *Anjali.* Thus, total *Meda* content of body is enumerated as 5 *Anjali* and total measurable body elements are counted as 56.5 *Anjali*, from this proportion, it is evident that total *Meda* content of body is 11 to 12% approximately. Modern physiology also mentioned the same amount of fat. This quantity may vary from person to person and exact measurement of body humorals is not possible due to unpredictable and ever changing nature of body.[14][16]

PATHOGENESIS ACCORDING TO AYURVEDA

Hetusevana is the first & foremost important event in initiation of *Samprapti*. *Hetusevana* leads to *Jathargni dushti* & *Kaphavriddhi*. When *Jatharagni* is impaired, the *Bhutagni* and *Dhatwagni* would also get impairment. This further leads in the formation of *Ama Annarasa* and subsequent *Ama Rasa Dhatu*. The *Ama Rasa Dhatu* leads to *Medodhatvagnimandya* leading to *Amarupa Medovridhi* which causes *Sthaulya* and *Medoroga*.

On other aspect, *Kaphavridhi* and this *Ama Meda Dhatu* formation leads to *Avarana* of *Vata* and *Sroto avarodha* which ultimately leads to *Vata Dosha* vitiation. Due to, *Sanga* in

Medovaha Srotas the nutrients cannot be carried by *Vyana Vayu* to their respective *Dhatus* (The process of circulation, digestion and proper distribution of *Dhatus* are controlled by S*amana* and *Vyana Vayu*). In this disease *Vata* has been mentioned in the state of *Aavrita* which provocates the Agni ultimately increasing the demand for the food (*Abhyavaharana Shakti*). Thus, vitiated cycle of pathogenesis starts.

But in case of *anya Nidanas* like *Beejadosha* & *Avarana* direct *Medovaha Srotodushti* occurs which results in the *Vriddhi* of *Ama Asthayi Medo Dhatu* or *Ama Sthayi Medo Dhatu* or both. The increase in *Ama Sthayi Medo Dhatu* results in *Atisthaulya* or Obesity whereas an increase in the *Ama Asthayi Medo Dhatu* would lead to conditions like *Ama Asthayi medodhatu Vriddhi* (Hyperlipidemia) or *Prameha* (Diabetes Mellitus).

The *Ama Asthayi Medo Dhatu* if untreated, on further progression causes *Margavarana* to *Vata* leading to the *Shoshana* and *Kathinya* of the *Sthanika Medo Dhatu*. This results in a condition termed as *Dhamani Pratichaya. Dhamani Pratichaya* or Atherosclerosis causes lesions in all the three *Maha Marmas Hridaya*, Shira and Basti which is evident as coronary heart disease, cerebrovascular diseases and renal insufficiency.[4][17]

AYURVEDIC MEDICINE IN HYPERCHOLESTEROLEMIA

The main concept to treat hyperlipidemia is *aama pachan* and increasing the agni. There are several plants and herbs mentioned in Ayurveda that are reported to be beneficial for hyperlipidemia. A list of drugs occurring in different *samhitas* having *medoghna* and *medohara* property is enlisted below.[18]

Table no 2: *Lekhaniya dravya* mentioned by *Acharya Charaka*.[13]

Charaka's *Gana*	Contents
Lekhaniya gana	Musta, Kushta, Haridra, Daruharidra, Vacha, Ativisha, Katurohini, Chitraka, Chirabilva, Haimavati

Table no 3: *Lekhaniya dravya* mentioned by *Acharya Susruta*.[16]

Sushruta samhita	Contents
Lekhaniya dravya	Shilajatu, Guggulu, Go-Mutram, Triphala, Loha raja, Rasanjana, Madhu, Yava, Mudga, Koradusha, Shyamaka Uddalaka

Table no 4: *Lekhaniya dravya* mentioned by *Acharya Sushruta* in different *ganas*.[16][19][20]

Sushruta's Gana	Contents
Salasaradi gana	Saalasaara, Ajakarna (Sarja), Khadira Kadara (Swetasaara), Kaalaskandha, Kramuka (Pooga), Bhoorja, Meshasringa (Karkatasringi), Tinisa (Syandana), Chandana, Kuchandana, Simsapaa, Sireesha, Asana (Beejaka). Dhava (Sakata), Arjuna (Kakubha), Taala, Saaka, Naktamaala, Pooteeka, Aswakarna, Agaru and Kaaleeyakam (Malendree chandanam).
Varunadi gana	Varuna, Aartagala (Kakubha), Sigru, Madhu Sigru, Tarkaaree, Mesha Sringee (karkatasringee), Pooteeka (Chirabilva), Naktamaala (Brihat Karanja), Morata (Ankolapushpa), Agnimandha, two kinds of Saireyaka 9of red and blue flowers), Bimbee, Vasuka (Buka), Vasira (Markatapippalee), Chitraka, Sataavari, Bilwa, Ajasringee (Chagalavishanikaa), Darbha (Kusa), Brihatee and Kantakaari
Rodhradi gana	Rodhra, Saavaralodhra, Palaasa, Kutannata, Asoka, Phanjee (Bhaarngee), Katphala, Elaavaalukam, Sallakee, Jinginee, Kadamba, Saala and Kadalee
Arkadi gana	Arka, Alarka (Sweta Arka), Karanja, Vitapakaranja, Naagadantee, Mayooraka (Apaamaarga), Bhaargee, Raasnaa, Indrapushpee, Kshudra Swetaa (Sephanda), Mahaaswetaa, Vrischikaalee, Alavanaa (Jyotishmatee), and Taapasa Vriksha (Induda)
Mushkakadi gana	Mushkaka (Kshaaravriksha), Palaasa (Kinsuka), Dhava, Chitraka, Madana, Vrikshaka (Kutaja), Simsapaa, Vajravriksha and Thriphala (Hareetaki, Vibheetaki and Aamalaki)
Ushakadi Gana	Ooshaka (Kshaaramrittika), Saindhavalavana, Silaajathu. Kaaseesadwaya (Vaalukaaseesam and Pushpukaaseesam), Hingu and Tuththtaka
Nyagrodadhi gana	Nyagrodha (Vata), Udumbara, Aswaththa, Plaksha, Madhuka, Kapeethana (Aamraataka), Kakubha, Aamra, Kosaamra, Chorakapatra (Laakshaavrikshaa), Jamboodwaya (Raajajamboo and Kaakajamboo – Swalpaphala), Piyaala (Saaradruma), Madhooka (Gudapushpa), Rohinee (Katphala), Vanjula (Vetasa), Kadamba, Badaree, Tindukee (Tinduka Vriksha), Sallakee, Rodhra, Saavararodhra, Bhallaataka, Palaasa and Nandeevriksha.
Tryushana	Pippalee, Maricha and Sringabera (Sunthee)

Table no 5: *Lekhaniya dravya* mentioned by *Acharya Vaghbhat.*[19][21]

Ashtang Hrudaya's Gana	Contents
Asanadi gana	Asana, Tinisha, Bhurja, Swetavaha(Arjuna), Prakiya (Chirabilva), Khadira, Kadara, Bhandi, Simshipa, Meshasrungi, the three Hima (shweta Chandan, rakta Chandan, Kaliyak), taala, Palasha, Jongaka (Agaru), Shaaka, Shaal, Kramuka, Dhava, Kalinga, Chaagakarna, Ashvakarna
Surasadi gana	The two Surasa (lrushna tulsi, shweta tulsi), Phanijja, Kalamala, Vidanga, Kharabusa, Vrsakarni (Mushkakarni), Katphala, Kasamarda, Ksavaka, Sarasi, Bharngi, Karmuka, Kakamachi, Kulahala (mundi), Visamusti, Bhutrna, Bhutakeshi
Vatsakadi gana	Vatsaka (Kutaja), Murva, Bharangi, Katuka, Maricha, Ghunapriya (Ativisha), Gandira, Ela, Patha, Ajaji (krushna jeerak), Katvanga phala, Ajamoda, Siddhartha (Sarshapa), Vacha, Jiraka, Hingu, Vidanga, Pasugandja (ajagandha), Panchakola
Vachadi gana	Vacha, Jalada (Mustaka), Devahva (Devdaru), Nagara, Ativisa, Abhaya (Haritaki)
Haridradi gana	the two Haridra(Haridra, Daruharidra), Yastimadhu, Kalasi (Prushnaparni), KutaJodbhava (Indrayava)

Various proprietary formulations including these drugs can be formulated and studied for treating hyperlipidemia.

Some of the researches showing effect on hyperlipidemia are

- *Arogyavardhini vati* is one of the proven drug for reducing hypercholesterolemia and related oxidative stress.[22]
- *Triphala* has been reported to reduce total cholesterol, triglyceride, free fatty acids and LDL-C significantly.[23]
- The *Kaishora Guggulu* formula acts as good blood purifier. It stimulates the *agni* and will help to digest the *aama*, while dealing with hypercholesterolemia.[3]
- Shilajit (Asphaltum) along with other drugs used in combination in a formulation, has been reported to reduce plasma cholesterol and lipid peroxidation in mice.[24]
- *Arjuna* possesses the potent properties of being antioxidant and hypolipidemic and has therapeutic potential for the prevention of coronary arterial disease.[25]
- *Withania somnifera* (Ashwagandha) and *Terminalia arjuna* (*Arjuna*) has been reported to reduce total and LDL-C and beneficial in cardiovascular diseases.[26][27]
- Ayurveda has discovered many more herbs and plant products such as garlic,[28] gum resin of the mukul myrrh tree,[29] ginger,[30] cinnamon,[31] *Azadirachta indica* (neem),[32]*Atasi,*[33] and turmeric,[34] that have been claimed to be beneficial for hyperlipidemia and cardiovascular disease.

Further research is needed to reveal the underlying mechanisms of single drugs as well as the new combinations.

DISCUSSION

Hyperlipidemia is a lifestyle disorder with increasing incidence and poses grave threat to health as it has no symptoms but leads to life threatening complications. As according to modern concept hyperlipidemia is a disease of disturbed the lipoprotein metabolism and liver is the main stay of the lipoprotein metabolism.

Dhamani Pratichaya is a *Santarpanjanya* condition as stated earlier. Hence its *Samanya Chikitsa* comprises of *Apatarpana*. *Dhamani pratichaya* and *margavarana* are the sequel of *shonitabhishyandana* (hyperlipidemia). The main concept to treat hyperlipidemia is *aama pachan* and increasing the *agni*.

Ayurveda focuses on the root cause of the disease i.e *Agnimandya* and related Dosha vitiation. The main aim of *Medoroga Chikitsa* is to alleviate main factors involved in the *Samprapti* of *Medoroga* which are *Nidana Parivarjana*, Restoration of *Medodhatvagni* to its normal state, balancing vitiated doshas, *i.e. kapha* and *vata* and correct the vitiated *Medovahasrota* & *Medodhatu.*

Measures like *Ullekhana, Raktamokshana, Vyayama, Upavasa, Dhuma, Swedana, Sakshaudra Ahara, Abhayaprasha, Rukshanna Sevana,* different types of *Churnas* and *Pradehas* can all be employed as *Aptarpana Chikitsa*.

The Dravya which are having *Katu, Kashaya Rasa, Ushna, Teekshna Guna and Lekhana, Deepana, Pachana* properties reduce *Kapha, Meda, Ama* and increase power of Agni are choice of drugs for treatment of hyperlipidemia.

Vamana, Virechana and *Lekhana Basti* are the *Shodhana* procedures being used successfully in practice for the disease.

All these factors will help in controlling body lipid levels and conditions like coronary heart disease and stroke can be prevented.

REFERENCES

1. F.SHATTAT G. A Review Article on Hyperlipidemia:Types, Treatments and New Drug Targets. Biomedical & Pharmacology Journal, 2014 December; 7(2).
2. García-Palmieri RACaMR. Clinical Methods- Chapter 31 Cholesterol, Triglycerides, and Associated Lipoproteins. 3rd ed. H Kenneth Walker MWDHMaJWHM, editor. Boston: Butterworths, 1990.
3. Anupama Kizhakkeveettil PSJ. Hypercholesterolemia and Ayurvedic Medicine: A Case Report. Topics in Integrative Health Care, 2011 June; 2(2).
4. Shipra singh DAKS. A CRITICAL REVIEW OF DYSLIPIDEMIA IN AYURVEDA. International Journal of Technical Research and Applications, 2018 MAY-JUNE; 6(3).
5. Rajalaxmi M.G GSA. Dhamani Pratichaya (Atherosclerosis) Eventuating Vata Vyadhi (disorders caused due to vata). International Ayurvedic Medical Journal, 2014 Sept-October; 2(5).
6. Christie W(W. The lipid web. [Online]. [cited 2020 February 13. Available from: https://www.lipidhome.co.uk/lipids/simple/lipoprot/index.htm.

7. Rohit Sane GASDRM. Evaluation of the lipid parameters in chronic heart failure patients and their correlation with body mass index. International journal of Advances in Medicine, 2019 March; 6(3).
8. Britannica TEoE. Encyclopædia Britannica. [Online]. [cited 2020 February 13. Available from: https://www.britannica.com/science/cholesterol.
9. Verma N. Introduction to hyperlipidemia and its treatment : A review. Int J Curr Pharm Res, 2016 November; 9(1).
10. Nelson RH. Hyperlipidemia as a Risk Factor for Cardiovascular Disease. Elsevier- NIH Public Access, 2014 March.
11. Priyanka Phogat ADPCSSKMSKRGKT. Introduction to Hyperlipidemia and Its Management: A Review. Pharmacologyonline, 2010; 2: 251-266.
12. Vichitra Kaushik SaVS. HYPERLIPIDEMIA: ITS MANAGEMENT AND INDUCTION. International Journal of Pharmaceutical Sciences and Research, 2014 August; 5(8).
13. Charak. Charak Samhita. 11th ed. tripathi DB, editor. Varanasi: Chaukhamba Surbharti Prakashan, 1997.
14. Vishal M Khandre PC. REVIEW OF MEDA DHATU IN RELEVENCE WITH SAMPRAPTI. Journal of Sanskrit Samhita Siddhanta, 2017 Apr - Jun; 2(4).
15. Kadlaskarbharat Bansi SSS. DYSLIPIDEMIA: AN AYURVEDIC APPROACH. International Journal of Applied Ayurved Research, 2016 MAY-JUNE; 2(7).
16. Sushruta. Sushruta Samhita. 71st ed. sharma DAr, editor. Varanasi: Chaukhambha Surabharti Prakashan, 2019.
17. Kole VMR. Review of kaphaj nanatmaj vyadhi with special reference to insulin resistance syndrome. World journal of pharmaceutical research, 2017 January; 6(2).
18. Harshitha Kumari RPaKN. Medohara and Lekhaniya dravyas (anti-obesity and hypolipidemic drugs) in Ayurvedic classics: A critical review. AYU, 2013 Jan - March; 1(34).
19. Sharma AP. Dravyaguna Vigyan. 3rd ed. Changani GS, editor. Varanasi: Chaukhambha Bharati Academy, 2012.
20. PULIKKOTTIL DAJ. Ayurveda treatment methods- Susruta's Classification of Drugs to 37 groups. [Online], 2017 [cited 2020 Feb 15. Available from: https://www.ayurvedatreatments.co.in/ayurvedatreatments/index.php/187-susrutas-classification-of-drugs-to-37-groups.

21. Vaghbhat. Ashtanga Hrudaya. 54th ed. Shastri PHS, editor. Varanasi: Chaukhambha Surabharti Prakashan, 2016.
22. Gajendra Kumar ASSKSaYKG. The hypolipidemic activity of Ayurvedic medicine, Arogyavardhini vati in Triton WR-1339-induced hyperlipidemic rats: A comparison with fenofibrate. J-AIM, 2013 July-Sept; 4(3).
23. Saravanan S SRMSJPNSDR. Hypolipidemic effect of triphala in experimentally induced hypercholesteremic rats. Pubmed, 2007 Feb; 2(127).
24. Rumi Ghosh PPKaVJK. Antioxidant and hypolipidemic activity of Kumbhajatu in hypercholesterolemic rats. IJAR, 2010 July-Sept; 1(3).
25. Saravanan Subramaniam SRSUVRG&GPD. Anti-hyperlipidemic and antioxidant potential of different fractions of Terminalia arjuna Roxb. bark against PX-407 induced hyperlipidemia. Indian Journal of Experimental Biology, 2011 April; 49.
26. Jaspal Singh Sandhu BSSSSCGSLMMP. Effects of Withania somnifera (Ashwagandha) and Terminalia arjuna (Arjuna) on physical performance and cardiorespiratory endurance in healthy young adults. International Journal of Ayurveda Research, 2010 July-September; 1(3).
27. Shridhar Dwivedi DC. Revisiting Terminalia arjuna – An Ancient Cardiovascular Drug. Journal of Traditional and Complementary Medicine, 2014 October–December; 4(4).
28. Sun YE WWQJ. Anti-hyperlipidemia of garlic by reducing the level of total cholesterol and low- density lipoprotein: A meta-analysis. Pubmed, 2018 May; 18(97).
29. Das S DABCCSMATS. A Comparative Study of Lipid-Lowering Effects of Guggul and Atorvastatin Monotherapy in Comparison to Their Combination in High Cholesterol Diet-Induced Hyperlipidemia in Rabbits. Pubmed, 2016 Jan; 13(5).
30. Alizadeh-Navaei R RFSMPMJFMA. Investigation of the effect of ginger on the lipid levels. A double blind controlled clinical trial. Pubmed, 2008 Sept; 9(29).
31. Seyed Mehrdad Kassaee MTGHRY. The effects of Cinnamomum Zeylanicum on lipid profiles and histology via up-regulation of LDL receptor gene expression in Hamsters fed a high cholesterol diet. Researchgate, 2016 August; 3(12).
32. R.R. Chattopadhyay MB. Effect of Azadirachta indica leaf extract on serum lipid profile changes in normal and streptozotocin induced diabetic rats. African Journal of Biomedical Research, 2005 April; 8.
33. H.Srinivasa Naik CSKSBSTNVKVP. Supplementation of whole grain flaxseeds (Linum usitatissimum) along with high cholesterol diet and its effect on hyperlipidemia and

initiated atherosclerosis in Wistar albino male rats. (October 2018). Veterian World. 2018 October; 11.

34. Myung-A Jung SYLHHHRNYLK&K. Hypocholesterolemic effects of curcuma longa L. with Nelumbo nucifera leaf in an in vitro model and a high cholesterol diet- induced hypercholesterolemic mouse model. Animal Cells and Systems, 2005 Feb; 19(2).