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COMPLEMENTARY AND ALTERNATIVE APPROACH TO TREAT *MEDADHATU DUSHTI* IN *PRAMEHA* (DIABETIC DYSLIPIDEAMIA)

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ABSTRACT

Patients with type II diabetes mellitus have several lipid abnormalities, including elevated plasma triglycerides (due to increased VLDL and lipoprotein remnants), elevated levels of dense LDL, and decreased plasma levels of HDL-C. Patients with type II diabetes mellitus are usually dyslipidemic, even when under relatively good glycemic control. Diabetic dyslipidaemia in India is one of the main causes for Coronary Artery Disease (CAD) mortality. As per critical judgment of some *Ayurvedic* authors of recent era, *Prameha* is compared and correlated with Diabetes mellitus and *Meda* is compared with body fat. *Meda* is considered as the first *Dushya* to get vitiated in the pathological process of *Prameha Roga* as aggravated *Kapha* vitiates it selectively due to their identical characteristics. In this paper effort is made to review some *Ayurvedic* herbs and dietary lifestyle to treat *Medodhatu Dushti* in *Prameha*.

KEYWORDS: *Medodhatu Dushti*, *Prameha*, Diabetes mellitus, Dyslipideamia.

INTRODUCTION

The international rise and incidence of diabetes is staggering. The WHO predicts that the global prevalence of Diabetes will increase to 300 million by 2025 with India set to have 57 million diabetics by 2025.[1] Macrovascular disease is the most common cause of morbidity and mortality in T2DM.[2] Two third of Type 2 diabetic patients die of macro vascular disease. Among them three fourth are from Coronary Artery Disease. There are several associations between dyslipidaemia and the increased risk of cardiovascular disease in patients with type 2 diabetes mellitus. Dyslipidaemia is the major risk factors for

macrovascular complications leading to cardiovascular disease (CVD) in type 2 diabetes mellitus (T2DM).[3,4] Macrovascular disease is defined as illnesses affecting the larger arteries supplying the heart, brain, and the legs, thereby causing ischemic heart disease, cerebrovascular disease, and peripheral vascular disease.[5] In patients with diabetes, alteration in distribution of lipid increases risk of atherosclerosis.

Persons with type 2 diabetes typically have atherogenic dyslipidaemia, which represents a risk factor beyond elevated LDL cholesterol. This form of dyslipidaemia in persons with diabetes is often called diabetic dyslipidaemia.[6] The term diabetic dyslipidaemia is synonymous with atherogenic dyslipidaemia.[7] Atherogenic dyslipidaemia is defined by elevation of serum triglycerides, presence of small LDL particles, and low HDL-cholesterol levels. For clinical purposes, elevated triglyceride (≥150 mg/dL) plus low HDL cholesterol (<40 mg/dL) define atherogenic dyslipidaemia.[8] It commonly occurs as one component of the metabolic syndrome. Insulin resistance is central to the pathogenesis of type 2 diabetes and contributes to dyslipidaemia.[9] Insulin resistance is associated with increased levels of serum insulin and depletion of b-cells and results in impaired regulation of circulating lipoprotein and glucose levels.[10] The increased flux of free fatty acids into the liver in the presence of adequate glycogen stores promotes triglyceride production, which in turn stimulates the secretion of apolipoprotein B (ApoB) and VLDL cholesterol.[11] The impaired ability of insulin to inhibit free fatty-acid release leads to enhanced hepatic VLDL cholesterol production[12] which correlates with the degree of hepatic fat accumulation.[13] The increased number of plasma VLDL cholesterol and triglyceride levels decrease the level of HDL cholesterol and increase the concentration of small dense LDL cholesterol.[14] Thus, the reason for three aforementioned phenotypes in athrogenic dyslipidaemia is the increased free fatty-acid release from insulin-resistant fat cells,[15,16,17] For atherogenic dyslipidaemia, treatment strategy focuses on triglycerides. Weight reduction and increased physical activity constitute first-line therapy for atherogenic dyslipidaemia, and three classes of drugs—statins, nicotinic acid, and fibrates—favorably modify the lipid abnormalities of atherogenic dyslipidaemia.[18] Low levels of exercise improve insulin sensitivity, maintain glycemic optimization, and reduce hypertriglyceridemia. The American Heart Association has recommended a minimum of 30 minutes of physical activity 5 days a week.[19]

Ayurveda with its holistic approach does the multi targeted action. *Ayurvedic* herbal medicines are multi targeted and act without much adverse reactions. Considering the

concept of *Snehatwa* we may correlate these lipids with the *Medo Dhatu*, *Vasa* and *Majja Dhatu*. Although they have *Snehatwa* as common feature but they differ in their site and function.[20] More importance is given to *Medo Dhatu* which is having role in developing many metabolic disorders like *Medoroga*, *Prameha* etc.

Abnormal accumulation of *Meda Dhatu* in body is known as *Medodushti*. *Medodushti* includes several numbers of other *Medovikaras*, which are collectively known as *Medoroga*. *Acharya Charaka* has described *Medodosha* under the title of *Atisthaulya*. Correlating *Prameha* with obesity, metabolic syndrome, and diabetes mellitus, the early manifestation of the disease process in these conditions, with carbohydrate, lipid, and protein metabolism disturbances accompanied by glycosuria, proteinuria, etc., correlate with *Kaphaja Prameha*, which can be easily controlled and cured.

Bahudrava Shleshma and *Abaddha Meda* are the two morbid components involved in pathogenesis of *Prameha*[21] which are also found in *Medoroga* too. As a result of physical inactivity and excessive intake of sweet substances, there is formation of *Bahudrava Shleshma* (*Kapha* that contains too much liquid) which joins and affects *Meda*, causing it to become *Abaddha* (unobstructed or fluid) in nature and *Ama*, which is a buildup of toxins from improperly digested food and metabolic products. The build up of *Bahudrava Shleshma* and *Ama* leads to additional formation of *Dushta Meda* (fat). This refers to an increase in adipose tissue, blood glucose level and blood lipid levels in the body, resulting in the individual becoming overweight, diabetic and dyslipidemic that is a state of metabolic syndrome.

The multifactorial involvement of *Meda* (fat), *Kapha*, *Vata*, and *Agni* (digestive metabolic activity) is a common pathophysiologic phenomenon of both *Prameha* and *Stha -ulya*. The role of *Dushta Meda* (fat/adipose tissue) is of great importance in the pathogenesis of *Prameha*. Its role is not only as *Dushya* (disturbed functioning of the *Dhatus*), but something more than that. In *Ayurveda*, *Ama* refers to the toxic intermediary products of digestion and metabolism that result from improperly digested food. The relationship between *Prameha* and *Ama* is well documented. If the *Agni* (digestive metabolic activity) is not proper, accumulation of *Ama* occurs, which ultimately leads to *Prameha* and *Medodushti*.

The measures used for *Sthaulya* (obesity) can be utilized for the management of *Prameha*, such as *Apatarpana* (Balanced diet with restricted calories). Measures that minimize the

morbid *Kapha* and *Meda* (fat) will improve the health of the patient. The foods recommended for *prameha* in the classical *Ayurvedic* texts should be included in the patient's diet. Balanced nutrition, appropriate physical exercise, and administration of herbal supplements will help to manage *Prameha, Medadhatu dushti*.

Recent exploration of *Ayurvedic* medicine by the World Health Organization, and other institutions suggests that this traditional system of health care has much to offer in the treatment and prevention of diseases. The World Health Organization (WHO) has listed 21,000 plants, which are used for medicinal purposes around the world. Among these 2500 species are in India, out of which 150 species are used commercially on a fairly large scale. India is the largest producer of medicinal herbs and is called as botanical garden of the world.[22] The current review focuses on medicinal plants used in the treatment of diabetic dyslipidaemia , a major crippling disease in the world leading to huge economic losses.

MEDICINAL PLANTS USED TO TREAT DIABETIC DYSLIPIDAEMIA

1. DARUHARIDRA

Botanical Name: Berberis aristata DC. **Family:**Berberidaceae **Hindi Name :** *Talamakhana,Rasaut, Chitra, Darhald* **used part :** Stem**,**bark, fruit, root, wood.**Chemical constituents :** Berberine, oxyberberine, berbamine, aromoline, karachine, palmatine, oxycanthine and taxilamine. **Medicinal Uses:** it is useful in treatment of jaundice, enlargement of spleen etc. **Pharmacological activities:** Hypoglycaemic, anticancer, anticoagulant, antipyretic, local anasthetic, antibacterial, hypotensive, anti-inflammatory, ant trachoma, CNS depressant.[23]

Therapeutic evaluation / Related researches

➢ Berberine is identified to lower the serum cholesterol level in human and hamster through the induction of low density lipoproteins (LDL) receptor in hepatic cells.[24]

➢ Effects of *B. aristata* on lipid profile and blood coagulation in hyperlipidemia induced rabbits, when evaluated, revealed the hypolipidemic effects of *B. aristata* and also indicated the probable influence on blood coagulation which is of importance in cardiovascular diseases.[25]

➢ Berberine reduce total Cholestrol, Low- density lipoprotein cholestrol , triglycerides & also has an important additive effect in the presence of statins.[26]

➢ The root extract of barberis with water, methanol and crude extract has potent and orally effective Antidiabetic component which either triggers the formation of insulin or shows insulin like effect.[27]

2. DEVADARU

Botanical Name: Cedrus deodara (Roxb.) Loud. **Family :**Pinaceae **Hindi Name :** *Debdar, Deyodar, Deodar*. **used part :** Heartwood, oil, leaf, bark, resin **Medical use** : The heartwood is useful in neuralgic disorders, filarisis, inflammations,bronchitis, tubercular glands, diabetes, fever, cardiac disorders etc. The bark is astringent, used in fever, diarrhoea and dysentery. **CHEMICAL CONSTITUENTS** : Dihydromyricetin, cedrine, deodorin and cedrinoxide, etc**.** (wood); cholesterin, lignins, tannins, β-sitosterol, himachalol, (+) longibesneol, allohimachalol, cis- & trans-atlantone, deodarone, deodarin (stem bark); **PHARMACOLOGICAL ACTIVITIES :** Spasmolytic, antiinflammatory, antimicrobial, antifertility, antiseptic, antidiabetic, cutaneous activity, immunomodulatory, analgesic, juvenile hormone activity[28]

Therapeutic evaluation / Related researches

➢ The extracts of Cedrus deodara decreased serum glucose, total cholesterol and triglyceride, low density lipoprotein (LDL) and very low density lipoprotein (VLDL) levels and increased high density lipoprotein (HDL) significantly has compared to MSG-control rats.[29]

➢ The ethanolic extract of bark of cedrus deodara exhibited significant antihyperglycemic activity and also lowers the biochemical parameters like SGPT, SGOT, cholesterol and triglycerides.[30]

3. *MUSTAKA*

Botanical Nam : Cyperus rotundus Linn. **Family:** Cyperaceae **Hindi Name:** *Nagarmotha, Motha* **Used part :** Tuber **Medical USES :** They are useful in anorexia, dyspepsia, flatulence, vomiting intestinal worms, diarrhoea, dysentery, vomiting, inflammations, fevers, skin diseases, epilepsy, cough, bronchitis, amenorrhoea, dysmenorrhoea, ophthalmic disorders. **CHEMICAL CONSTITUENTS :** ketoalcohols, α- rotunol, β- rotunol, oleanolic acid and its glycoside, oleanolicacid- 3- 0- neohesperidoside alongwith sitosterol, sesquiterpenes- α- cyperone, cyperene, β- selinine in tubers. **PHARMACOLOGICAL ACTIVITIES :** Tranquillizing, antiinflammatory, antipyretic, diuretic, estrogenic, anti-emetic, smooth muscle relaxant, antimicrobial and juvenile hormone mimicking activity.[31]

Therapeutic Uses and Experimental Studies/ Researches

- Administration of *C. rotundus* extract restored the age associated change in serum lipids (total cholesterol, LDL cholesterol, DL cholesterol, triglycerides and VLDL triglyceride level) to the level of young control rats. In young rats, treatment of *C. rotundus* significantly increased HDL cholesterol level.[32]
- A pilot study carried out on 30 obese people who were administered the powdered tuber of *C. rotundus* for 90 days, showed reduction in weight along with a decrease in serum cholesterol and triglycerides.[33]
- Treatment with the standards and different doses of *Mustaka* extract exerted statistically significant ($P < 0.05$) reduction in serum TC, LDL, TG, HDL levels at the end of 15 days of intervention.
- The phenolic compound isolated from Cyperus rotundus has alpha amylase inhibitory activity. In addition to this it is also reported for having the Antidiabetic activity.[34]

4. VIBHITAKI

Botanical Name: *Terminalia bellirica* (Gaertn.) Roxb. **Family:** Combretaceae **Hindi Name:** *Baheda, Bhaira, Behara.* **Used part:** Fruit, seed, bark **Medicinal USES:** The bark is mildly diuretic and is useful in anaemia and leucoderma. Fruits are useful in cough, asthma, bronchitis, pharyngitis, insomnia, flatulence, vomiting, cardiac disorders, haemorrhages, ophthalmic disorders, splenomegaly, leprosy, fevers, ulcers, general debility, diarrhoea and dysentery. **CHEMICAL CONSTITUENTS :** fructose, galactose, glucose and its galloyl derivative, mannitol and rhamnose, β- sitosterol and bellericanin (fruits) **PHARMACOLOGICAL ACTIVITIES :** Purgative, blood pressure depressant, antifungal, antihistaminic, activity against viral hepatitis and vitiligo, antiasthmatic, broncho-dilatory, anti-spasmodic antibacterial, CNS stimulant.[35]

Therapeutic evaluation /related researches

- Gallic acid present in fruit rind of *T. bellerica* is the active principle responsible for the regeneration of β-cells, increasing plasma insulin, C-peptide and glucose tolerance level and decreasing serum total cholesterol, triglyceride, LDL-cholesterol, urea, uric acid, creatinine.[36]
- *Haritaki*, *Amla* and *Vibhitaki* all three drugs reduced serum cholesterol, aortic sudanophilia and cholesterol contents of liver and aorta.[37]

➢ The aqueous extract of *Terminalia bellerica* have significant activity on reducing the Total cholesterol, LDL and VLDL levels, and also significantly increased HDL levels and histopathology results shows that , aqueous extract treated group there is less accumulation of lipids in the walls of the arch of aorta.[38]

➢ Terminalia bellerica fruit extracts restored all the biochemical parameters related to the patho-biochemistry of diabetes mellitius and prevented diabetic nephropathy , dyslipidaemia and other diabetes induced complications.[39]

➢ Water extract of *Terminalia Chebula* improves glucose tolerance and brings down Fasting blood glucose in diabetic rats.[40]

5. HARITAKI

Botanical Name : *Terminalia chebula* Retz**. Family:** Combretaceae **Hindi name :** *Hara, Harara, Harad, Harre.* **Used part :** Fruit **Medicinal USES :** They are useful in wounds, ulcers, inflammations, leprosy, stomatitis, hyperacidity and associated gastric disorders, haemorrhoids, jaundice, hepato-splenomegaly, helminthiasis, anaemia, pharyngitis, cough, coryza, asthma, scrotal enlargement, urinary disorders, ophthalmic diseases, intermittent fevers, cardiac disorders, filaria, obesity, neuropathy, rheumatiod arthritis, dandruff, general debility. **CHEMICAL CONSTITUENTS :** Anthraquinone glycoside, chebulinic acid, chebulagic acid, tannic acid, terchebin, tetrachebulin, vitamin C (fruits) **PHARMACOLOGICAL ACTIVITIES :** Antimicrobial, antispasmodic, hypotensive, indurance promoting activity, anti hepatitis B virus activity, hypolipidaemic, purgative.[41]

Therapeutic evaluation / Related researches

➢ Haritaki is found to be effective in reducing the level of total lipids, serum TG, Sr. cholesterol, LDL & VLDL significantly; also increasing the HDL levels significantly.[42]

➢ The effect of Ethanolic extract of fruits of *T. Chebula*, given orally showed significant reduction of Serum Cholesterol & Serum triglycerides level in Hyperlipidaemic rats.[43]

➢ The oral administration of *Haritaki* fruits chloroform extract reduced the elevated blood glucose & reduced the increase in glycosylated Haemoglobin in streptozotocin induced diabetic rat.[44]

➢ It also possessed hypocholesterelomic activity against cholesterol-induce hypercholesterolemia and atherosclerosis in rabbits.[45]

6. AMALAKI

Botanical Name: *Phyllanthus emblica* Linn. Syn. *Emblica officinalis* Gaertn. **Family:** Euphorbiaceae **Hindi Name:** *Amlaki, Amalaki, Amvala, Aonla, Amla.* **Used part :** Root bark, stem bark, leaf, fruit, seed **Medicinal USES :** useful in ulcerative stomatitis and gastric ulcer, gonorrhoea, jaundice, diarrhoea and myalgia, dyspepsia, dysentery, diabetes, cough, asthma, bronchitis, headache, ophthalmic disorders, colic, flatulence, erysipelas, skin diseases, leprosy, anaemia, emaciation, hepatic disorders, intrinsic haemorrhages, leucorrhoea, menorrhagia, cardiac disorders, intermittent fevers and greyness of hair. **CHEMICAL CONSTITUENTS :** A good source of vitamin C; carotene, nicotinic acid, riboflavine, D-glucose, D-fructose, myoinositol and a pectin with D-galacturonic acid, D-arabinosyl, D-xylosyl, L-rhamnosyl, D-glucosyl, D-mannosyl and D-galactosyl residues, embicol, mucic, Indole acetic acid and four other auxins- a1, a3, a4 and a5, two growth inhibitors- R1 & R2; phyllembic acid and phyllembin (fruits) **PHARMACOLOGICAL ACTIVITIES :** Spasmolytic, mild CNS depressant, hypolipidaemic, antiatherosclerotic, antimutagenic, antimicrobial, antioxidant, immunomodulatory, antifungal, antitumour, hypoglycaemic, antiinflammatory, antibacterial, antiulcer, adrenergic potentiating, HIV-1 reverse transcriptase inhibitory action.[46]

Therapeutic evaluation / Related researches

- The effect of *Emblica* fruit & Vit.C (6mg/kg) on cholesterol induced Hypercholesterolaemia & atherosclerosis. Both reduced the serum cholesterol.[47]
- *E. officinalis* fruit has anti-hyperglycemic and lipid-lowering properties in normal as well as diabetic human volunteers.[48]
- Amla juice & pulp (35mg/kg/day) have prevented the development of experimental atheroma both in aorta & coronary artery. Amla (fed to rabbits) showed Hypolipidaemic & Anti -atherosclerotic activity.[49]
- Serum cholesterol, TG, phospholipid and LDL, levels were significantly decreased by administration of amla.[50]
- Significant anti-hyperlipidemic, hypolipidemic,and anti-atherogenic effect which may contribute to its anti-atherogenic activity.[51]

7. GUGGULU

Botanical Name: *Commiphora wightii (Arnott) Bhandari Syn. C. mukul (Hk. ex Stocks) Engl.* **Family :** Burseraceae **Hindi Name :** *Guggul, Gogil, Guggul, Gugal, Mukul*. **Used**

part : Resin. **Medicinal uses :** It is useful in rheumatoid arthritis, gout, sciatica, paralysis, neuralgic pains, diplegia, scrofula, skin disorders, leucoderma, worm infestations, haemorrhoids, dyspepsia, flatulence, tubercular peritonitis, chronic colitis, diarrhoea, tubercular ulceration of bowels, cough, laryngitis, bronchitis, asthma, pulmonary Koch's, pneumonia, whooping cough, pectoral and hepatic disorders, ottorrhoea, epilepsy, fever, pyelitis, cystitis, urinary calculi, dysuria, dysmenorrhoea, amenorrhoea, leucorrhoea, menorrhagia, wounds, ulcers, cardiac disorders, coronary thrombosis. **Chemical Constituents/Phytoactives :** The gum resin contains two hypolipidaemic agents Z & E guggulusterons,sesamin, essential oils (polymyrcene & caryophyllene) , linoleic, oleic, palmitic & stearic acid, campesterol, cholesterol, betasitosterol, stigmasterol, aminoacids, viz. ,alanine, arginine,aspartic acid, cystine, glutamic acid, histidine,isoleucine,leucine, lysine, proline, serine, threonine, tryptophan, tyrosine, & valline **Pharmacological Action : Hypolipidaemic**, Antibacterial,Atherosclerotic, anthelmintic, anti-arthritic, antiviral, Ca2+ antagonist activity, anti-inflammatory, anti-rheumatic, **Hypocholestremic**, antifertility; Fibrinolytic activity.[52]

Therapeutic evaluation / Related researches

- Clinical studies on patients of hypercholesterolemia associated with obesity, ischaemic heart disease , hypertension, diabetes, etc. showed a fall in total serum cholesterol and serum lipiphosphorus when treated with guggulu.[53]
- It increase the feacel excretion of bile acids (cholic and deoxycholic acids) , cholesterol and lows the intestinal absorbtion of fats and cholesterol.[54]
- Effect of Guggulusteron isolated from *Commiphora mukul* in high fat diet induced Diabetic rats suggestive of both Hypoglycaemic & Hypolipidemic effect which help to cure Type II DM.[55]

8. *GUDUCHI*

Latin Name: *Tinospora Cordifolia* **Family:** Menispermaceae **Hindi name :** Gulancha, Giloy, Amrita, Gulneha, Gulbel. **Part used :** *Stem* **Chemical Constituents/Phytoactives** Tinosporine,Tinosporon,Tinosporic acid, Tinosporide, Tinosporidine, columbin, cordifol chasmanthin,palmarin,berberine, giloin, giloinsin, beta-sitosterol,cordifolide, unosporine, heptacosanol, Cardifolon, Tembetarine, arabinogalactan. **Pharmacological Action** T. Cordifolia has shown Antistress activity, CNS depressant and hypoglycaemic activity. Anti inflammatoryand Hepatoprotective activity, significant improvement in Kupffer cell function.

It has also Immunomodulatory effect, Anti- neoplastic, Antiendotoxic, Adaptogenic, Diuretic activities.[56]

Therapeutic evaluation /related researches

- Administration of aq. Extract showed significant improvement Antihyperglycemic activities in mild to moderate degree of Hyperglycemias. It implies that the Antihyperglycemic effect of these plant is dependent upon dose of Diabetogenic agent & therefore on degree of bête cell destruction.[57]
- The anti-oxidant activity of root extract is reported in Alloxan diabetic rats.[58]
- Administration of aq. Extract of roots significantly reduced the serum & tissue cholesterol, phospholipids & free fatty acids in Alloxan diabetic rats. The root extract showed highest Hypolipidemic effect.[59]

9. VIDANGA

Latin Name: *Embellica ribes* **Family :** Myrsinaceae **_Hindi name:** Vayvidanga, Bhabhiranga **Used part:** fruits. **Chemical Constituents/Phytoactives :** Embelin (embolic acid), Potassium embelate (2,5-dihydroxy, 3-undecyl-1, 4-benzoquinone) Vilangin, alkaloid christembine, a volatile oil, quercitol, tannins and fatty acids. **Pharmacological Action** - Active principles- estrogenic and weakly progestogenic. Pulp is purgative. Fresh juice is cooling, diuretic and laxative. The root anti diarrhoeal. The seeds- spermicidal, Oxytoxic and Diuretic, Blood purifying property, Hypotensive and Anti-pyretic, **Antihyperlipidaemic**, Antioxidant.[60]

Therapeutic evaluation / Related researches

- Effect of Embelin **on its lipid lowering activity** in experimental fibrosarcoma. Methylcholantherene-induced fibrosarcoma was transplanted in rats, and after 30 days, embelin (50 and 100 mg/kg, p.o.) was administered[61]
- Researchers investigated **the lipid-lowering and antioxidant potential** of an ethanolic extract of *E. ribes* in Streptozotocin-induced diabetes in rats. Significant decrease in blood glucose, serum total cholesterol, and triglycerides, and increase in HDL-cholesterol levels when compared to controls**.**[62]

10. CHITRAKA

Latin Name: *plumbago zeylanica***_Family:** Plumbaginaceae ***Hindi name :*** *Motha.* **Used part:** Root **Chemical Constituents/Phytoactives:** Root contains active substance plumbagin

– 0.91%, 3- chloroplumbagin, zeylinone,plubagic acid, nepthelenone. **Pharmacological Action:** Antipyretic, appetiser, uterotonic, antibacterial, antifungal, antifertility, anticancer (plumbagin), anticoagulant, antitumour, hepatoprotective, cytotoxic, appetiser and CNS depressant.[63]

Therapeutic evaluation / Related researches

- It Possesses following pharmacological activities – Appetiser , anticoagulant[64], hepatoprotective, antioxidant[65], hypolipidaemic[66], antiatherosclerotic, cardiotonic[67], antibacterial, uterotonic, antipyretic, antitumer, and CNS- Depressant .
- Plumbagin feeding brings about a definite regression of atheroma and prevents the accumulation of cholesterol and triglycerides in liver and aorta.[68]

CONCLUSION

The number of people suffering from diabetic dyslipidaemia has been increasing dramatically over the past few decades, and this demands special attention towards its management. The few conventional therapies available are either expensive or often related with adverse effects; therefore, various traditional therapies with antihyperglycemic and hypolipidemic effect are increasingly sought by patients. Medicinal plants provide better alternatives as they are generally less-toxic and affordable; yet, their safety and efficacy needs more evaluation by controlled clinical studies. Although herbs are less likely to have drawbacks of the conventional drugs used for diabetes, potential herb -drug interactions should be kept in mind for those receiving conventional antidiabetic and hypolipidemic medications. Taking all these details into account, further research is required to validate the antidiabetic and hypolipidemic effects of medicinal plants.

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