

## HYPOCHOLESTEROLEMIC PLANTS – A REVIEW

Shetty Niveditha Hegde Prakash L. Harini A.

Dept. of Dravyaguna, SDM College of Ayurveda & Hospital, Hassan, Karnataka, India

### ABSTRACT

Hypercholesterolemia is major risk factor for atherosclerosis and associated cardiovascular diseases. Of late there has been an increasing emphasis placed on screening for high cholesterol to reduce risk factor of heart diseases. High costs and adverse effects of hypercholesterolemia medications have led to the search for alternate treatments. Plants have increasingly become attractive alternatives to prevent or treat these conditions. In this article few preclinical and clinical studies on hypocholesterolemic activity of commonly used Ayurvedic and other plants is discussed. Further high grade studies with randomized clinical trials should be conducted for better perception of the effectiveness of Ayurvedic treatment for hypercholesterolemia.

**Keywords:** hypercholesterolemia, Ayurveda

### INTRODUCTION

Hypercholesterolemia refers to abnormally increased levels of cholesterol or in other words abnormally increased plasma lipoproteins. Increased plasma cholesterol concentration in hypercholesterolemic patients is a major risk factor for atherosclerosis<sup>1</sup>. It has been firmly established that hypercholesterolemia has directly proportionate relationship with atherosclerosis and IHD<sup>2</sup>. Over the last two decades there has been an increasing emphasis placed on screening for high cholesterol to reduce risk of heart diseases. However, adverse effects<sup>3</sup> associated with therapeutic drugs warrant to find other alternative approaches for effective management of hypercholesterolemia. So not only new drugs but drugs with excellent safety profile, cost effectiveness is need of the hour and all this contribute to the emerging trend of research in indigenous medicinal plants to prevent or treat these conditions. Ayurveda with its holistic approach can help, with its well-organized

materia medica in which plants form a dominant part. Few preclinical and clinical study on hypocholesterolemic activity, which confirm the efficacy of many of the Ayurvedic and other collateral plants some of which are remarkably effective, are discussed.

Freshly prepared *Triticum aestivum* Linn. (Poaceae) grass juice was administered to normal rats at the dose of 5 ml/kg and 10 ml/kg orally once daily for 21 days in Wistar rats weighing 140-200g. Study indicated hypolipidemic activity of drug as it produced dose related significant ( $P < 0.05$ ) reduction in total cholesterol (TC), triglycerides (TG), low density lipoprotein-cholesterol (LDL) and very low density lipoprotein-cholesterol (VLDL) levels in normal rats as compared to control. Presence of alkaloids, tannins, saponins and sterols revealed in preliminary phytochemical screening seemed to have caused these changes<sup>4</sup>.

Study on the effect of *Aloe barbadensis* Mill. (Liliaceae) leaf extract on the serum cholesterol level of experimentally induced hypercholesterolemic male Ca-

lotus versicolor Daudin was carried out. Four groups of Calotes were given *Aloe barbadensis* extract in four different doses (3 mg/kg, 4 mg/kg, 5 mg/kg and 6 mg/kg/day) for 21 days. There was a significant decrease in serum cholesterol levels in all the drug treated groups. Significance level was 5% for a dose of 6 mg/kg and other doses i.e. of 3mg/kg, of 4 mg/kg & of 5 mg/kg show significant decrease at 0.1%, 0.5% and 0.2% level, respectively. However the fall in serum cholesterol was very high i.e. below normal cholesterol level when the dose was of 6 mg/kg. The probable mode of action was attributed to the flavonoids present in it. As the dose of *Aloe barbadensis* Mill. increased there was sharp fall in the serum cholesterol level. The results of this study showed significant lowering of serum cholesterol in *Aloe barbadensis* Mill. treated animals. But the dose needs a careful evaluation<sup>5</sup>.

*Asparagus racemosus*(AR) willd. (Liliaceae), root was studied for hypercholesterolemic and antioxidant potential in both normal and hypercholesterolemic male albino rats weighing 150-200g. Normal and hypercholesterolemic rats were administered with root powder of AR(5 and 10 g% dose levels) along with normal and hypercholesterolemic diets, respectively, for duration of 4 weeks. Inclusion of root powder in diet resulted in a dose-dependent reduction in plasma and hepatic lipid profiles, increased faecal excretion of cholesterol, neutral sterol and bile acid along with increase in hepatic HMG-CoA reductase activity and bile acid content in hypercholesterolemic rats. Further, asparagus root also improved the hepatic antioxidant status (catalase, SOD and ascorbic acid levels). No significant changes in lipid and antioxidant profiles occurred in the normocholesterolemic rats administered with root powder. Hence it can be

useful as a dietary supplement that offers a protection against hyperlipidemia/hypercholesterolemia in hypercholesterolemic animals. The probable mode of action indicate that the phytosterols, saponins, polyphenols, flavonoids and ascorbic acid, present in the drug could be responsible to enhance hyperlipidemic/hypercholesterolemic and oxidative stress in hypercholesterolemic conditions<sup>6</sup>.

Methanol extract of *Nauclea latifolia* Smith. (Rubiaceae) fruit for 4 weeks was studied for its cholesterol lowering effect in hyperlipidemic Albino rats weighing 39-40g. The crude fruit sample lowered plasma cholesterol at 40, 60 and 80% feed supplementation studied and this was dose dependent. Results showed that *Nauclea latifolia* Smith. possesses hypocholesterolemic potential statistically significant ( $P < 0.05$ ) when compared with the control, and is relatively non-toxic ( $LC_{50} = 1240.73 \mu\text{g/ml}$ ). The cholesterol lowering potential of the fruit may be ascribed to the modification of cholesterol uptake from the intestine, conversion of cholesterol to bile acids and increased excretion of bile acids by the plants phytoconstituents. Phytochemicals present in it like, oxalate, tannin, phytate, saponins may be contributing to Hypocholesterolemic effect<sup>7</sup>.

Methanolic extract of *Erythrina variegata* Linn. (Fabaceae) Seed(200 & 400 mg/kg) for 90 days in hyperlipidemic wistar rats weighing 200-250 g, reduced elevated levels of TC, TG, LDL, VLDL, and HMG-CoA reductase activity which was statistically significant [ $P < 0.001$ ]. Phytochemicals like oleic linoleic acid, beta-sitosterol, campesterol, stigmasterol was found. Probable mode of action observed for the protective effect may be attributed to the decrease in cholesterol synthesis, increase in cholesterol excretion and

expression of low density lipoprotein receptor & subsequent catabolism<sup>8</sup>.

Alcoholic extract of *Sphaeranthus indicus* Linn. (Asteraceae) flower for 8 days was tested on hyperlipidemic male albino rats weighing 150-200 g. 500mg/kg/day drug significantly decreased the level of TC, and LDL as compared to control & increased high density lipoprotein (HDL) and it also reduced atherogenic index. Phytoconstituents like tannin and alkaloid were found and probable mode of action may be due to increase in activity of lecithin and marked reduction in triglycerides may be due to increase in activity of endothelium bound lipoprotein lipase which hydrolyses the triglyceride into fatty acids or due to inhibition of lipolysis so that fatty acids do not get converted into triglyceride<sup>9</sup>.

Ethanol extract of *Terminalia pallida* Brandis (Combretaceae) fruits for 30 days was studied in experimentally induced hyperlipidemic Sprague drawley male rat's weighing 160-180g. 100 mg/kg./day for 30 days showed significant reduction in total cholesterol, low density lipoprotein, very low density lipoprotein cholesterol coupled together with elevation of high density lipoprotein cholesterol and diminution of atherogenic index ( $P < 0.001$ ) in comparison with the control group<sup>10</sup>.

*Cyamopsis tetragonoloba* Linn., (Fabaceae) is popularly known as cluster beans. Freeze-dried tender cluster bean powder was investigated for 8 weeks on experimentally induced hyperlipidemic male Wistar rats 90-95 g. Observations revealed that cluster bean powder enhanced bile acid secretion, inhibited absorption of cholesterol, increased excretion of neutral sterols; also might have entrapped fat micelles thereby impeding fat absorption. Rats fed with the plant sample

at 12.5% and 25% showed reduced plasma cholesterol. Statistically significant ( $P < 0.05$ ) when compared with the control. Significant anti-hypercholesterolemic effect was seen in cluster bean fed animals, the decrease in serum cholesterol being particularly in the LDL associated fraction. There was also a beneficial increase in HDL associated cholesterol fraction. Hepatic lipid profile showed a significant decrease in both cholesterol and triglycerides as a result of feeding tender cluster beans along with high cholesterol diet<sup>11</sup>.

A comparative clinical study on hypolipidemic efficacy of *Embllica officinalis* Gaerten. in patients with type II hyperlipidemia was studied and its hypolipidemic effects were compared with those of simvastatin. Sixty type II hyperlipidemic patients of both sexes were selected for the trial. Out of 60 selected patients, 40 were treated with *Embllica officinalis* Gaerten. capsule (500mg); 20 pts were given simvastatin capsule (20 mg) daily for 42 days. *Embllica officinalis* Gaerten. Produced significant reduction of TC ( $P < 0.0001$ ), LDL ( $P < 0.0001$ ), TC and VLDL ( $P < 0.002$ ), and a significant increase in HDL levels ( $P < 0.0002$ ). Whereas simvastatin produced significant reduction of total cholesterol ( $P < 0.0001$ ), LDL ( $P < 0.0009$ ), TC and VLDL ( $P < 0.017$ ), and a significant increase in HDL level ( $P < 0.0001$ ). Above findings suggested that *Embllica officinalis* Gaerten. produced significant hypolipidemic effect along with reduction in blood pressure. Probable mode of action explained was due to several mechanisms such as an interference with cholesterol absorption. Inhibition of HMG Co-A reductase activity, and increase in Lecithin-Cholesterol Acyltransferase (LCAT) activity<sup>12</sup>.

Single-blind, placebo controlled study, on 150 hyperlipidemic patients was

carried out to study the effects of *Anthemum graveolens* Linn. and *Allium sativum* Linn. on lipid profile in hyperlipidemic patients. Patients were divided into three equal groups randomly each composing of 50 patients. Enteric-coated garlic powder tablet (equal to 400 mg garlic, 1 mg allicin), anethum tablet (650 mg) and placebo tablet was given twice daily to these groups respectively. It was observed that enteric-coated garlic tablet can reduce total cholesterol, low density lipoprotein and increase high density lipoprotein, with no effect on triglyceride. On the other hand, *Anethum graveolens* Linn. cannot be an antihyperlipidemic agent<sup>13</sup>.

## DISCUSSION AND CONCLUSION

Hypocholesterolemic or hypolipidemic activity can be correlated to medohara karma or lekhaneya karma in classics, as lipids can be equated with medho dhatu<sup>14</sup>. *Shatavari* (*Asparagus racemosus* Willd.)<sup>15</sup>, *Paribhadra* (*Erythrina variegata* Linn.)<sup>16</sup>, *Kadamba* (*Nauclea latifolia* Smith.)<sup>15</sup>, *Mundi* (*Sphaeranthus indicus* Linn.)<sup>16</sup>, *Amalaki* (*Embllica officinalis* Gaerten)<sup>17</sup>, are described as *medohara* in *Ayurveda*. Above review on research papers on hypocholesterolemic studies provide the experimental and clinical evidence to confirm the hypocholesterolemic activity of these plants and uphold the classical claim. Hence there is an instant need to include and achieve “meaningful use” of *medohara* drugs for providing clinical and public health benefit in hypercholesterolemic conditions. Some drugs like *Karanja*<sup>18</sup> leaves and *Guggulu*<sup>19</sup>, have not exhibited hypocholesterolemic activity, in spite of being told as *medohara*<sup>15, 20</sup> in *Ayurveda*. Such studies increase the importance to revalidate these research works and establish the efficacy of our drugs. Efforts should be directed towards discovery, Identification, revalidation of our drugs

with hypocholesterolemic potential and vigorous attempt should be made to incorporate new drugs into Ayurvedic pharmacopeia. All animal trial should undergo clinical trials, to affirm the efficacy of these drugs in humans and practical application is needed to assure the role of these drugs in treating hypercholesterolemic conditions. Further high quality studies with randomized clinical trials should be conducted for better perception of the effectiveness of Ayurvedic treatment for hypercholesterolemia.

## REFERENCES

1. Kumar V, Abbas AK, Fautso N, Mitchell RN. Robbins Basic Pathology. 8<sup>th</sup>ed. New Delhi: Elsevier Health Sciences; 2007. p345
2. Harsh Mohan. Textbook of Pathology. 6<sup>th</sup> ed. New Delhi: Jaypee Brothers Medical Publishers; 2010. p.393
3. Tripathi KD. Essentials of Medical Pharmacology. 6<sup>th</sup> ed. New Delhi: Jaypee Brothers Medical Publishers; 2006 p.615-8
4. Kothari S, Jain AK, Mehta SC, Tonpay SD. Effect of fresh *Triticum aestivum* grass juice on lipid profile of normal rats. Indian J Pharmacol [Serial on the internet]. 2008 October [cited 2013 December 14]; 40(5): 235–6 [about 2 pages].
5. Chandrakar M, Palekar S, Chirade S, Hafiz SAM. Hypocholesterolemic effect of Aloe vera (L.) extract on high cholesterol fed *Calotes versicolor* Daudin. Asian J. Exp. Sci. [Serial on the internet]. 2008[cited 2013 December 14];22(3) [about 4 pages].
6. Nishant P, Visavadiya, Narasimhacharya AVR. Asparagus Root Regulates Cholesterol Metabolism and Improves Antioxidant Status in Hypercholesteremic Rats. Evid Based Complement Alternat Med [Serial on the internet]. 2009 June [cited 2013 December 14]; 6(2): 219–226 [about 12 pages].

7. James O, Ugbede HH. Hypocholesterolemic Effects of Nauclea latifolia (Smith) Fruit Studied in Albino Rats. American Journal of TROPICAL MEDICINE & Public Health [Serial on the internet]. 2011 [cited 2013 December 14];1(1):11-21[about 11 pages].
8. Balamurugan G, Shantha A. Effect of Erythrina variegata seed extract on hyperlipidemia elicited by high-fat diet in wistar rats. J Pharm Bioallied Sci [Serial on the internet]. 2010 Oct [cited 2013 December 14];2(4):350-5[about 6 pages].
9. Pande VV, Dubey S. Antihyperlipidemic activity of Sphaeranthus indicus on atherogenic diet induced hyperlipidemia in rats. International Journal Of Green Pharmacy [Serial on the internet]. 2009[cited 2013 December 14];3(2):159-161[about 3 pages].
10. Sampathkumar MT, Kaseti RB, Nabi SA, Sudarshan PR, Swapna S, Apparao C. Antihyperlipidemic and antiatherogenic activities of Terminalia pallida Linn. fruits in high fat diet-induced hyperlipidemic rats. Journal of Pharmacology and Bioallied Sciences[Serial on the internet]. 2011 Jul-Sep[cited 2013 December 14];3(3):449–452[about 3 pages].
11. S Pande. Antihypercholesterolaemic influence of dietary tender cluster beans (Cyamopsis tetragonoloba) in cholesterol fed rats. Indian Journal of Medical Research [Serial on the internet]. 2012 March [cited 2013 December 14];135(3):401–406[about 6 pages].
12. Gopa B, Bhatt J, Hemavathi KG. A comparative clinical study of hypolipidemic efficacy of amla (Emblica officinalis) with 3-hydroxy-3-methylglutaryl-coenzyme-A-reductase inhibitor simvastatin. Indian J Pharmacol [Serial on the internet]. 2012 [cited 2013 December 14];44(2):238-42 [about 5 pages].
13. Kojuri J, Vosoughi AR, Akrami M. Effects of anethum graveolens and garlic on lipid profile in hyperlipidemic patients. Lipids in Health and Disease [Serial on the internet]. 2007
14. Phadke AS. A review on lipid lowering activities of Ayurvedic and other herbs. Natural product radiance. 2007;6(1):81-89
15. Shastri A, Editor, Sushruta Samhita of Sushruta. 14<sup>th</sup> ed. Varanasi: Chaukhambha Sanskrith Sansthan; 2003. Part I. p. 142
16. Misra B, Vaisya R editor. Bhavaprakasha Nighantu of Sri BhavaMishra. 9<sup>th</sup>ed. Varanasi: Chaukhambha Sanskrith Sansthan; 1999. Part I. p.334.
17. Shastri A. Editor, Sushruta Samhita of Sushruta. 14<sup>th</sup>ed. Varanasi: Chaukhambha Sanskrith Sansthan; 2003. Part I. p. 143
18. Baroda S, Chaturvedi N, Kumar P, Gupta MD, Gaidhani SN, Wanjari MM. Absence of hypolipidemic effect of *Holoptelea integrifolia* leaf extract in tyloxapol-induced hyperlipidemic rats. Journal of Pharmaceutical Negative Results [Serial on the internet].; 2012 [cited 2013 December 14];3 (1): 16-21
19. Ulbrichta C, Basch E, Szapary P, Hammerness P, Axentsev S, Boon H, Kroll D, Levi Garrawayd, Mamta Vorah, Jen Woodsh. Guggul for hyperlipidemia: A review by the Natural Standard Research Collaboration. Complementary Therapies in Medicine. 2005; 13: 279-90
20. Misra B, Vaisya R editor. Bhavaprakasha Nighantu of Sri BhavaMishra. 9<sup>th</sup>ed. Varanasi: Chaukhambha Sanskrith Sansthan; 1999. Part I. p.204.

---

#### CORRESPONDING AUTHOR

Dr. Niveditha Shetty  
PG Scholar, Dept. of Dravyaguna,  
SDM College of Ayurveda & Hospital,  
Hassan, Karnataka, India  
Email: [nivedithaprakashshetty@gmail.com](mailto:nivedithaprakashshetty@gmail.com)

Source of support: Nil

Conflict of interest: None Declared