Research Article

www.ijrap.net

EVALUATION OF HYPOLIPIDEMIC ACTIVITY OF AMURCHITA AND MURCHITA GHRITA

Vinay. R. Kadibagil [1]*, Revanasiddhappa S. Sarashetti [2]

[1]Department of Rasashastra and Bhaishajya Kalpana, Shri Dharmasthala Manjunatheshwara College of Ayurveda & Hospital, B.M Road, Thanniruhalla, Hassan, Karnataka, India

[2]Principal and Dean, N.K. Jabshetty Ayurvedic Medical College and P.G Centre, Bidar, Karnataka, India

Received on: 25/04/17 Accepted on: 19/06/17

***Corresponding author**
E-mail: drvinaykadibagil@gmail.com

DOI: 10.7897/2277-4343.083145

ABSTRACT

Hyperlipidemia is metabolic disorder that is characterized by high levels of lipids in the blood and may be associated with disorders such as diabetes mellitus, hypothyroidism, kidney failure or cushing's syndrome. It is belief of common people that by consumption of oil or ghee will lead to hyperlipidemias Before the preparation of any oushadhi siddha (medicated) taila and ghrita, murchana (processing of ghee) a kind of samskara (procedure) is strongly advocated as aadousamurchayet sneham in bhaishajya ratnavali. This samskara (procedure) contributed significantly by changing organoleptic and physicochemical characters. To explore more scientific evidence, amurchita (unprocessed) and murchita ghrita (processed ghee) samples were subjected for experimental study. On administration of amurchita and murchita ghrita (processed ghee) in albino rats, the results shown murchana samskara (processing of ghee) helps to reduce total cholesterol, LDL, triglycerides and increase in HDL. This contributes to reduce harmful effects of fats which are considered to play a significant role in atherosclerosis and other cardiac diseases. katu (pungent), tikta (bitter), kashaya (astringent) rasa (taste), laghu (light for digestion) ruksha (dry) guna (properties), kaphahara doshagnata, lekhaniya (scraping) karma (action) of the drugs used in murchana samskara (processing of ghee) might have contributed.

Keywords: ghrita, murchita ghrita (processed ghee), Hyperlipidemia, Total cholesterol, LDL, Triglycerides, HDL

INTRODUCTION

Ghrita (ghee), taila (oil), vasa (fat) and majja (marrow) are mainly four sneha dravya mentioned in Ayurvedic classics. Goghrita and tila taila are said be best among all jangama (animal origin) and sthavara (plant origin) sneha respectively. It is belief of common people that by consumption of oil or ghee will lead to hyperlipidemias. Before the preparation of any oushadhi siddha (medicated) taila and ghrita, murchana (processing of ghee) a kind of samskara (procedure) is strongly advocated as aadousamurchayet sneham in bhaishajya ratnavali. The physico – chemical standards available for the standardisation of sneha kalpana are insufficient. To support and validate these physico-chemical parameters experimental studies are necessary.

Hyperlipidemia is an elevation of lipids (fats) in the bloodstream. These lipids include cholesterol, cholesterol esters (compounds), phospholipids and triglycerides**.** It is of utmost significance because it leads to atherosclerosis of vessels (arterial walls) leading to vascular diseases. Hyperlipidemias may be associated with disorders such as diabetes mellitus, hypothyroidism, kidney failure or cushing's syndrome. They may also be a result of the use of corticosteroid drugs. Hyperlipidemias are associated with development of atherosclerosis and coronary artery disease.

Hyperlipidemia does not bear a precise reference in Ayurveda though the study of Ayurvedic literature bears some implicit allusion. This might be because it is a metabolic disorder and not a fully-fledged disease in itself. It is auxiliary to several other severe conditions like coronary artery disease, cerebrovascular accidents, metabolic syndrome etc. In Ayurveda various attempts have been made to use distinctive nomenclature to denote the word Hyperlipidemia as follows

a) rasagata sneha vriddhi
b) rasa raktagata sneha vriddhi
c) medovriddhi
d) medoroga or medodosha
e) ama medo dhatu.

The study of Ayurvedic literature bears certain ambiguous references pertaining to an increase in the amount of circulating body lipids, yet the literal meaning of hyperlipidemia is not found to be distinctly stated anywhere. The study of hyperlipidemia can be done on the basis of studying two of the closest diseases in Ayurveda having some amount of relation with hyperlipidemia are atisthaulya or medo roga and prameha

Objectives

1) To evaluate the hypolipidemic activity of amurchita ghrita (ghee) and murchita ghrita (processed ghee)
2) To assess the importance of murchana samskara (processing of ghee) by comparing the experimental results of amurchita ghrita (ghee) and murchita ghrita (processed ghee)

MATERIALS AND METHODS

Experimental Animals

Wistar strains, Albino rats of either sex between 170 to 270 g were obtained from animal house attached to department of Pharmacology, SDM Centre for Research for Ayurveda and Allied Sciences, Udupi. The experimental protocol was approved by the institutional ethical committee under the reference no-CPCSEA/IAEC/2014-15SDMHSN-05. The animals were fed with normal rat diet and water ad libitum, cholesterol solution (40% cholesterol) throughout the study.

They were acclimatized in the laboratory condition for one week prior to the experimentation. The housing provided has the following conditions: controlled lighting of 12:12h light and dark cycle, temperature of 25ºC and relative humidity of approximately 50%.

Animal Grouping

Table 1: Grouping of animals with drug and respective dose

Sl no	Group	Drug	Dose	No of animals
1.	Normal control	CMC 0.5%	5ml/kg	6
2.	Test drug group I	amurchita ghrita (ghee)	4320mg/kg	6
3.	Test drug group II	murchita ghrita (processed ghee)	4320mg/kg	6

Experimental protocol

Wistar strain albino rats of either sex weighing 170 g to 270g were divided into 3 different groups, six in each group. Control group rats were administered with CMC at a dose of 5 ml /kg (1ml/200gm) with normal diet and water ad libitum.
1st and 2nd groups were administered with amurchita and murchita ghrita (processed ghee) samples (864mg/200gm body weight of albino rats) respectively. Both test drugs were administered at morning hour for 21 consecutive days. The test drugs were administered directly due to their liquid form with the aid of gastric catheter.

Collection of blood sample and biochemical analysis from serum

The blood was collected from the orbital plexuses at the end of the experiment on 21st day; 4h after the last drug administration using light ether anesthesia. The biochemical investigation was carried out to assess total cholesterol, high density lipoprotein, low density lipoprotein and triglycerides.

OBSERVATIONS AND RESULTS

Table 2: Effect of Test drug amurchita (ghee) and murchita ghrita (processed ghee) on serum total Cholesterol level

Group	Total cholesterol
Normal control	52.66 ± 4.31
amurchita ghrita (ghee)	65.33 ± 3.14
murchita ghrita (processed ghee)	43.33 ± 4.15

An apparent increase in the serum total cholesterol level was observed in amurchita ghrita (ghee) compared to murchita ghrita (processed ghee) group.

Table 3: Effect of amurchita and murchita ghrita (processed ghee) on HDL cholesterol level

Group	HDL
Normal control	26.83 ± 3.26
amurchita ghrita (ghee)	29.33 ± 3.53
murchita ghrita (processed ghee)	52.03 ± 3.24

Usage of murchita ghrita (processed ghee) leads to telling accumulation in HDL cholesterol compare, in balance to the normal control and Amurchita Ghrita (ghee) groups.

Table 4: Effect of amurchita (ghee) and murchita ghrita (processed ghee) on LDL cholesterol level

Group	LDL
Normal control	17.00 ± 1.21
amurchita ghrita (ghee)	13.66 ± 1.80
murchita ghrita (processed ghee)	7.86 ± 1.03

Usage of amurchita ghrita (ghee) prompts increment in LDL cholesterol level in contrast with the murchita ghrita (processed ghee) group.

Table 5: Effect of amurchita and murchita ghrita (processed ghee) on Serum Triglycerides Level

Group	Triglycerides
Normal control	89.5 ± 5.70
amurchita ghrita (ghee)	116 ± 14.10
murchita ghrita (processed ghee)	82.33 ± 15.14

Administration of murchita ghrita (processed ghee) leads to significant decrease in serum triglyceride level in murchita ghrita (processed ghee) group compared to amurchita ghrita (ghee) group.

Table 6: Summary of effect of ghrita (ghee) samples on lipid profile

Group	Total cholesterol	HDL	LDL	Triglycerides
Normal control	52.66 ± 4.31	26.83 ± 3.26	17.00 ± 1.21	89.5 ± 5.70
amurchita ghrita (ghee)	65.33 ± 3.14	29.33 ± 3.53	13.66 ± 1.80	116 ± 14.10
murchita ghrita (processed ghee)	43.33 ± 4.15	52.03 ± 3.24	7.86 ± 1.03	82.33 ± 15.14

DISCUSSION

The main objective of the present study was to determine the hypolipidemic potential of amurchita ghrita (ghee) and murchita ghrita (processed ghee) samples on albino rats.

Before analysis of the results obtained in the present study it would be essential to briefly summarize different steps involved in lipoprotein metabolism, which is very important for the regulation of lipid levels in the blood. Chylomicrons the largest of the lipoproteins are mainly involved in the transport of triglycerides of dietary origin and are formed in the intestine. Triglycerides are removed from the chylomicrons in different tissue through a reaction involving hydrolysis by the enzyme lipoprotein lipase. Thus the VLDL formed in the liver acts as a vehicle for the transport of triglycerides to different parts of the body. The VLDL triglycerides are hydrolyzed to provide free fatty acids for storage in adipose tissue and for routing them to β-oxidation pathway for providing energy requirement in tissues like cardiac and skeletal muscles. After the removal of triglycerides the VLDL remnant gets converted to LDL. Part of the remnant is converted to LDL by removing the further amount of triglycerides. LDL is catabolized in the hepatocytes by the hydrolysis of cholesteryl ester in its core. This cholesterol

is utilized in the preparation of cell membranes[7].

HDL plays very important role in preventing the artherogenesis by taking away the cholesterol from the arterial wall and by inhibiting the oxidation of atherogenic lipoproteins. The protein part of this molecule is synthesized in the liver and secreted in intestine. Surface layers of chylomicrons and VLDL acquire the lipid part of HDL during lipolysis. It also acquires cholesterol from the tissues by an alternate pathway. This free cholesterol is moved from the cytosol to the cell membrane by a transporter protein termed as ABC1 from which the cholesterol is acquired by prebeta-1-HDL. This is followed by esterification of cholesterol by the enzyme lecithin –cholesterol acyl transferase leading to the formation of bigger HDL molecule. From HDL cholesterol it is transferred to VLDL, IDL, LDL and Chylomicron remnants through the activity of an enzyme known as Cholesteryl ester transfer protein.

HDL is the only lipoprotein particle capable of receiving cholesterol from the peripheral cells by a process known as reverse cholesterol transport. Nascent HDL particles containing apo A-I and phospholipids are synthesized in liver. These HDLs rapidly acquire additional un-esterified cholesterol and phospholipids from peripheral tissues. HDL cholesterol is transported to hepatocytes by both an indirect and a direct pathway. HDL cholesteryl esters are transferred to apo B containing lipoproteins by cholesteryl ester transfer protein (CETP), which are then removed from liver by LDL receptor mediated endocytosis. Modulating the activity of the important and rate limiting enzymes and transporter proteins would lead to marked changes in the lipid profile

Effect on lipid profile

Total cholesterol in normal control group was 52.66 ± 4.31, amurchita ghrita (ghee) was 65.33 ± 3.14 and in murchita ghrita (processed ghee) was 43.33 ± 4.15. Total cholesterol was increased in amurchita ghrita (ghee) group compared to normal control group and murchita ghrita (processed ghee) group. It indicates that after murchana samskara (processing of ghee) total cholesterol is decreased.

Cholesterol is a "wax-like" substance found in the body. It is produced by the body, but is also consumed from animal products in diet. Body need some cholesterol, but too much can cause blockages in our arteries. High cholesterol is a serious risk for heart disease.

Total cholesterol is made up of LDL-Cholesterol, HDL-Cholesterol and a portion of triglycerides. Total cholesterol is the most important risk factor for those who do not have diabetes or heart disease[8].

HDL in normal control group was 26.83 ± 3.26, Amurchita Ghrita (ghee) was 29.33 ± 3.53 and in Murchita Ghrita (processed ghee) was 52.03 ± 3.24. HDL was increased in Murchita Ghrita (processed ghee) group compared to normal control group and Amurchita Ghrita (ghee) group.

HDL-cholesterol is the "good" form of cholesterol. It helps remove the excess LDL-cholesterol from the body. HDL has a lot of protein and very little cholesterol.

Women should have HDL-cholesterol levels greater than 50 mg/dL

Men should have HDL-cholesterol levels greater than 40 mg/dL.

HDL-Cholesterol Values (mg/dL)	Possible Outcome
<40	Major risk factor for heart disease
>60	Protective against heart disease

LDL in normal control group was 17.00 ± 1.21, in amurchita ghrita (ghee) group was 13.66 ± 1.80 and in murchita ghrita (processed ghee) group was 7.86 ± 1.03. LDL was decreased in murchita ghrita (processed ghee) group compared to normal control group and Amurchita Ghrita (ghee) group. It indicates that murchana samskara (processing of ghee) attributes special properties & monounsaturated & omega 6 fatty acids might have been increased due to which LDL is decreased[10].

LDL-cholesterol is the "bad" form of cholesterol. It causes blockages in arteries and increases risk of heart attack and stroke.
Saturated fats can raise LDL (bad) cholesterol. Monounsaturated fats can help to lower the amount of LDL (bad) cholesterol in blood. There are two main types of polyunsaturated fats: omega 3 fats and omega 6 fats. Omega 6 fats can help to lower LDL (bad) cholesterol. Omega 3 fats can help heart to keep a healthy rhythm and prevent blood clots. They can also help to lower another type of fat in the blood called triglycerides. Trans fats lower HDL (good) cholesterol and raise the level of LDL (bad) cholesterol in the blood.

Triglycerides in normal control group was 89.5 ± 5.70, amurchita ghrita (ghee) was 116 ± 14.10 and in murchita ghrita (processed ghee) was 82.33 ± 15.14. Triglycerides were increased in amurchita ghrita (ghee) group compared to normal control group and murchita ghrita (processed ghee) group.

Triglycerides are a type of fat found in the blood. These are the most common type of fat and a major source of energy. Triglycerides are the storage form of excess calories. High triglyceride levels are associated with decreased HDL-cholesterol levels and an increased risk of heart disease.

Murchana samskara (processing of ghee) attributes special properties to ghrita (ghee) by which monounsaturated and polyunsaturated fatty acids are increased and trans fatty acids are decreased. Due to these changes there is decrease in total cholesterol, LDL, Triglycerides and increase in HDL was observed in murchita ghrita (processed ghee) group. This and analytical study provides evidence base to 'aaduo murchayeta sneha' mentioned in bhaishajya ratnavali.

For ghrita murchana samskara (processing of ghee), haritaki (*Terminalia chebula*), amalaki (*Emblica offficinalis*), bibhitaki (*Terminalia bellirica*), haridra (*Curcuma longa*), musta (*Cyperus rotandus*) and matulunga (*Citrus medica*) are mentioned in bhaishajya ratnavali. Recent studies show following properties of these drugs.

In atherogenic diet induced hyperlipidemic model, the rats receiving Treatment with *Terminalia chebula* (haritaki) showed significant reduction in total cholesterol, triglycerides, Total protein and elevation of high density lipoprotein cholesterol. haritaki (*Terminalia chebula*) was found to possess significant hypolipidemic activity[17]

Terminalia chebula (Haritaki) extract pretreatment was found to ameliorate the effect of isoproterenol on lipid peroxide formation and retained the activities of the diagnostic marker enzymes in isoproterenol induced myocardial damage in rats. Its pericap has also been reported to have cardio protective activity in isolated frog heart model [17].

Terminalia chebula (haritaki) extract administration showed hypolipidaemic activity against experimentally induced atherosclerosis and hypocholesterolemic activity against cholesterol-induced hypercholesterolemia and atherosclerosis. Triphala formulation was found to have hypolipidaemic effects on the experimentally induced hypercholesteremic rats[12]

In laboratory studies, *Emblica offficinalis* (amalaki) has been proven to effective for high cholesterol and prevention of atherosclerosis. It strengthens the heart muscles and causes a significant decrease in total cholesterol, LDL cholesterol, VLDL cholesterol and triglycerides. A 500mg capsule of dried amalaki (*Emblica offficinalis*) powder can be added to your daily routine after consulting with doctor[19].

Recent researches have recommended that turmeric (*Curcuma longa*) may also help to save you atherosclerosis, the development of plaque which could block arteries and result in coronary heart attack or stroke. In animal studies, it turned into discovered that, an extract of turmeric reduced the cholesterol levels and stored LDL (bad) cholesterol from building up in blood vessels. Because it stops platelets from clumping together, turmeric might also save you blood clots from developing up alongside the partitions of arteries. Another double-blind, placebo-managed take a look at determined that taking curcumin, the active component in turmeric, at a dose of up to four g in step with day did not increase cholesterol levels.

Atherosclerosis is a condition in which fat substance like cholesterol collects and thickens the vein wall. Late review assessed the impacts of curcumin (*Curcuma longa*) in lessening the serum levels of cholesterol and lipid peroxides in ten human volunteers. The administration of Curcumin (at 0.5 g/day) to the volunteers for 7 days indicates diminished in serum lipid peroxides by 33% and aggregate serum cholesterol levels by 11.63%, and expanded HDL cholesterol by 29%. Due to these properties, curcumin was recommended to go about as a chemo preventive operator against atherosclerosis. [9].

In another study administration of *Cyperus rotundus* (musta) 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 *Cyperus rotundus* significantly increased HDL cholesterol level [18]

A observe carried out on petroleum ether extract of Citrus medica (matulunga) seeds (2 hundred and 400 mg/kg) shows giant discount (p< zero.05) of fasting blood glucose, serum ldl cholesterol, serum triglycerides, LDL and VLDL in dose dependent way after 15 days of drug administration. though 2 hundred mg/kg/day seed extract for 15 days was not showing any alternate in HDL level, at the same time as 400 mg/kg/day dose substantially elevated HDL degree in diabetic rats. So it's far concluded that Citrus medica seeds have giant anti diabetic, hypocholesterolemic and hypolipidemic pastime.[19].

Recent studies reveal that triphala, haridra (*Curcuma longa*), musta (*Cyperus rotandus*) and matulunga (*Citrus medica*) have hypolipidemic and cardio protective properties. These properties of drugs have attributed the hypolipidemic activity of Murchana Samskara (processing of ghee). The analytical study also shown increased in Dodecanoic acid, gondoic acid, oleic acid and unsaturated fatty acids expected to contribute beneficial effect in increasing HDL cholesterol, in decreasing risk of developing cardiovascular diseases and in reducing risk of male infertility and growth retardation.

Table 7: Guna (properties) karma (action) of drugs used for ghrita murchana

Details	**Haritaki**	**Bibhitaki**	**Amalaki**	**Haridra**	**Musta**	**Matulunga**
Latin Name	*Terminalia chebula*	*Terminalia bellirica*	*Emblica offficinalis*	*Curcuma longa*	*Cyperus rotandus*	*Citrus medica*
Rasa	pancharasa except lavana	kashaya	pancharasa except lavana,	tikta, katu	tikta-katu, kashaya	amla
Guna	laghu -ruksa	laghu-ruksa	ruksa-sita	ruksa –laghu	laghu- ruksa	guru -sita snigdha
Virya	usna	usna	sita	usna	sita	usna
Vipaka	madhura	madhura	madhura	katu	katu	amla
Dosa-ghnata	tridosa	tridosa-kapha	tridosa-pitta	kapha + pitta	kapha + pitta	kapha + vata
Karma	rasayana, pathya, dipana, pacana, anulomana, yogavahi	virecana, bhedana, chaksusya, kesya	rasayana, vrusya, caksusya, rucikara, madakara	kusthaghna lekhaniya kandughna visodhani	kusthaghn, lekhaniya, truptighn, grahi, dipan-pacana	tarpana, sramaghna, rocana, krmihara, chardihara, medhya
Roga-ghnata	kustha, prameha, grahani, swasa-kasa, vibandha	kustha, krimi	kustha, vibandha, prameha, raktapitta, visarpa	kustha, kandu, krimi,meh, pandu, vrana	krmi, raktajaroga, trisna, jwara	krmi, sula, arsoghna, gulma, ajirna

As mentioned in classical books the drugs used in ghrita murchana are having katu (pungent), tikta (bitter), kashaya (astringent) rasa (taste), laghu (light for digestion) Ruksha (dry) Guna (properties), kaphahara doshagnata and lekhaniya (scraping) karma (action). These Guna (properties) karma (action) are attributed the medohara property (hypolipidemic activity) in murchita ghrita (processed ghee).

CONCLUSION

Results of experimental study show murchana samskara (processing of ghee) contributes specific properties in ghrita (ghee) to reduce total cholesterol, LDL, Triglycerides and to increase HDL in ghrita (ghee). This effect is useful to reduce harmful effects of fats which are considered to play a significant role in atherosclerosis and other cardiac diseases. Hypolipidemic

activity in Ghrita (ghee) is attributed by the drugs used in the murchana samskara (processing of ghee) having Katu (pungent), tikta (bitter), kashaya (astringent) rasa (taste), laghu (light for digestion) ruksha (dry) guna, kaphahara doshagnata, lekhaniya karma (action). These attribute the medohara property (hypolipidemic activity) to murchita ghrita (processed ghee). Recent studies also show ie triphala, musta (*Cyperus rotandus*), haridra (*Curcuma longa*) and matulunga (*Citrus medica*) which are used for murchana samskara (processing of ghee) have hypolipidemic and cardio protective activity. Lowering of serum total cholesterol indicates one of the following possibilities. The drugs used in the ghrita murchana (processing of ghee) may interfere with the absorption of cholesterol from the GI tract by adsorption or by inhibiting lipase activity on the dietary fats. The second modulation may be down grading cholesterol synthesis. The third possibility is increasing the utilization of cholesterol by promoting its increased utilization for the formation of bile salts. It seems that the drugs used for ghrita murchana (processing of ghee) have modulating effect on all or any one or two of the above mechanisms. Lowering of triglyceride may be indicative of modulation of Chylomicron and VLDL metabolism. Drugs used for ghrita murchana (processing of ghee) seem to have good modulation of this probable mechanism. It may also be interfering with the formation of triglyceride or its peripheral utilization in tissues like skeletal muscles. Murchana samskara (processing of ghee) attributed special properties in the ghrita (ghee). Experimental study has shown the significant reduction in total cholesterol, LDL, Triglycerides and increase in HDL. It is also supported by analytical study which has shown increased in Dodecanoic acid, Gondoic acid, oleic acid etc unsaturated fatty acids are expected to contribute beneficial effect in increasing HDL cholesterol, which may contribute in decreasing risk of developing cardiovascular diseases and in reducing risk of male infertility and growth retardation. Murchita ghrita (processed ghee) is therapeutically efficacious than amurchita ghrita (ghee). Hence Bhaishajya Ratnavali statement stands scientific and beneficial.

REFERENCES

1. Wikipedia, the free encyclopedia. Lipid hypothesis
2. Duff G, McMillan G. Pathology of atherosclerosis. The American Journal of Medicine. 1951;11(1):92-108.
3. Enas E, Chacko V, Pazhoor S, Chennikkara H, Devarapalli H. Dyslipidemia in South Asian patients. Current Atherosclerosis Reports. 2007;9(5):367-374.
4. National Cholesterol Education Program. ATP III Guidelines At-A-Glance Quick Desk Reference. https://www.nhlbi.nih.gov/guidelines/cholesterol/atglance.pdf
5. Shastri p. Sharangadhara samhita. 5th ed. Varanasi: Chaukhambha orientalia; 2002.
6. Trikamji Y. Charaka samhita. 9th ed. Varanasi: Chaukambha sanskrit sansthan; 2012.
7. Trikamji Y. Charaka samhita. 9th ed. Varanasi: Chaukambha surbharati prakashan; 2011.
8. http://www.e-mercy.com/images/cholesterol-metabolism/research/2/Guidelines-to-Interpret-Results-from-Health-Screening.pdf
9. Journal Of Insurance Medicine Copyright E 2009;41:244–253
10. The Journal of American Science, 2(1), 2006, Ma, Cholesterol and Human Health
11. William P. Castelli, M.D., Joseph T. Doyle, M.D.,Tavia Gordon, Curtis G. Hames, M.D., Marthana C. Hjortland, Ph.D.,Stephen B. Hulley, M.D., Abraham Kagan, M.D. And William J. Zukel, M.D., the Cooperative Lipoprotein Phenotyping Study on HDL Cholesterol and Other Lipids in Coronary Heart Disease,
12. www.irishheart.ie/media/pub/informationleaflets/a_healthy_cholesterol_2011__final.pdf
13. http://indianheartjournal.com/ihj09/may_june_09/265-274.html
14. AAPS J. 2013 Jan; 15(1): 195–218.Published online 2012 Nov 10. doi: 10.1208/s12248-012-9432-8
15. http://www.world-heartfederation.org/fileadmin/user_upload/documents/Publications/Global-CVD_Atlas.pdf
16. International Journal of Pharma Tech Research CODEN (USA): IJPRIF Vol.6, No.1, pp 97-116, Jan-March 2014
17. International Journal of Pharmacy and Pharmaceutical Sciences Vol 4, Suppl 3, 2012
18. International Journal of Scientific and Research Publications, Volume 3, Issue 5, May 2013 1
19. International Journal of Pharmaceutical & Biological Archives 2012; 3(6):1292-1297
20. Ascherio A. Trans fatty acids and coronary heart disease. New England Journal of Medicine.1999; 340(25):1994-1988
21. Sampath Kumar K.P., Bhowmik Debjit, Dutta Amitsankar, Yadav Akhilesh Pd., Paswan Shravan, Srivastava Shweta, Deb Lokesh,www.phytojournal.com, Vol. 1 No. 1 2012

Cite this article as:

Vinay. R. Kadibagil *et al*. Evaluation of hypolipidemic activity of Amurchita and Murchita ghrita. Int. J. Res. Ayurveda Pharm. 2017;8(3):63-67 http://dx.doi.org/10.7897/2277-4343.083145

Source of support: Nil, Conflict of interest: None Declared

Disclaimer: IJRAP is solely owned by Moksha Publishing House - A non-profit publishing house, dedicated to publish quality research, while every effort has been taken to verify the accuracy of the content published in our Journal. IJRAP cannot accept any responsibility or liability for the site content and articles published. The views expressed in articles by our contributing authors are not necessarily those of IJRAP editor or editorial board members.