

Research Article

Effect of Dried Ginger (*Zingiber officinale*) on Serum Total Cholesterol Level in Hyperlipidemic Patients

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Abstract |

Objective: To study the effect of dried ginger on serum cholesterol and to compare the pre and post interventional serum cholesterol level in hyperlipidemic patients.

Methods: It was a randomized, single-blind, placebo controlled study in which 100 hyperlipidemic patients, 50 in treatment group and 50 in placebo group, participated. Baseline sampling of subjects, with ginger in diet, was done before administration of first dose. Ginger capsules and placebo were administered orally to the respective groups, for 30 days. Blood samples were collected next day after administration of the last dose. Lipid profile tests were performed on samples and readings were recorded in tables. Data was reported as means \pm SEM. Means of intervention values, both pre and post, were compared using a paired t-test, p-value ≤ 0.05 was considered as significant.

Result: It was found in treatment group, there was a substantial decrease (p-value = 0.000) in serum cholesterol level of hyperlipidemic patients. Whereas, in placebo group, the serum cholesterol level changed insignificantly (p-value = 0.168).

Conclusion: This finding shows that dried ginger powder in a dose of 3g/day can significantly decrease serum cholesterol level in hyperlipidemic patients.

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Introduction

Hyperlipidemia is a word used for abnormally raised levels of any or all of lipids in plasma.¹ Cholesterol is a waxy steroid that is synthesized in liver or intestine. It not only helps in the production of hormones but also in the stability of membranes. It is transported in blood plasma in combination with lipoproteins. It is an important structural element of cell membrane in mammals. It is vital for appropriate membrane permeability and fluidity. Moreover cholesterol is an important factor for the production of bile acids,² steroid hormones and vitamin D.

There are different types of cholesterol like, total cholesterol, good cholesterol which is labeled as HDL and bad cholesterol which is labeled as LDL.³ Factors contributing to high cholesterol levels are unhealthy life style and bad dietary habits. Other causative factors are lack of exercise, alcohol abuse, being overweight, and having a sedentary lifestyle.⁴

Hyperlipidemia includes conditions like hypercholesterolemia and hypertriglyceridemia, which are associated with an increase in plasma concentration of cholesterol and triglycerides and respectively.⁵ Hyperlipidemia is highly prevalent in Pakistani popu-

lation.⁶ It is closely associated with heart disease which is the most common cause of death.⁷ Natural herbs have been used regularly in abundance due to their beneficial effects on health. Ginger and other herbs have been a component of most of traditional herbal medicines for many centuries. Ginger has a botanical name of *Zingiber officinale*, and is a part of Zingiberaceae family.⁸ Zingiber has its origin in Greek word "Zingiberis" and Arabic word "zins-zebil", meaning known already to prehistoric generations. Whereas the usual term ginger gets its origin from Sanskrit word Sringavera, "gringa" means horn and "vera" means body. Its root known as rhizome, is used for culinary and medicine purposes. Ginger chemically exerts its effect by its components essential oils and pungent principals.⁹ Essential oils are sesquiterpene hydrocarbons and monoterpenes¹⁰ and pungent principles comprise of zingerone, gingerol and shogaol.¹¹ Ginger helps to treat different diseases like hypertri-glyceridemia, cardiac ailments, pain of gastric ulcer, malignancy, IBS irritable bowel syndrome and bacterial infections and increased cholesterol levels.¹² In customary oriental medicine ginger has been used for treating asthma, edema, ear pain, diarrhea, dyspnea, nausea and vomiting.¹³ Different scientific studies have shown that ginger consumption reduces plasma cholesterol levels.¹⁴ It also causes decrease synthesis of cholesterol by liver.¹⁵ New classes of drugs used to manage hyperlipidemia are being developed day by day. It is the need of the hour to discover compounds, which carry more advantages than their complications. This now calls for new research, and development of new and better quality drugs with least side effects. This is the basis that we have studied the effect of dried ginger consumption on serum cholesterol in patients of hyperlipidemia.

Methods

This was a randomized, single blind placebo controlled study conducted in Department of Biochemistry of Postgraduate Medical Institute, Lahore General Hospital for a period of seven months. The study was conducted as per Helsinki declaration of human rights. It was approved by ethical review committee of PGMI, Lahore. The study included 100 patients, 50 each in treatment and placebo group. The study included hyperlipidemic patients of either sex, with an age group of 35-60 years. Whereas individual who were diabetic, pregnant, had suffered from transient ischemic attacks, having hypersensitivity to ginger or

were receiving lipid lowering drugs were not included in the study. Also patients suffering from malignancy, peptic ulcer, urinary tract and kidney diseases were excluded. All the subjects gave an informed consent before participating in the study. They refrained from ingesting any other medication known to alter lipid levels for the period of enrolment. Their history along with dietary habits was recorded in a questionnaire. The subjects did not change their medication and dietary habits during intervention phase. Locally grown dried ginger was identified and purchased from the market. Ginger root was oven dried at 70°C overnight to remove any moisture and fungal growth. It was grinded, weighed and put in capsules in a sterile environment. Placebo capsules were prepared using lactose. Baseline sampling of subjects (fasting), with ginger they normally took in the diet was done before administration of first dose of ginger. Capsules filled with ginger powder 3g/day in two divided doses along with placebo were administered orally to subjects in treatment and placebo groups respectively for 30 days⁽¹⁶⁾. Fasting blood samples were collected next day after the administration of last dose of ginger. Data was reported as mean \pm SEM. Means of pre and post intervention values were compared within the groups using paired t-test. A p-value ≤ 0.05 was considered as significant.

Results

In treatment group there was a significant decrease (p-value = 0.000) in blood cholesterol level of hyperlipidemic patients from 199.1 ± 4.56 to 161.1 ± 3.18 . Whereas, in the placebo group, the blood cholesterol level changed insignificantly (p-value = 0.168) from 198.6 ± 4.65 to 199.6 ± 4.76 .

Discussion

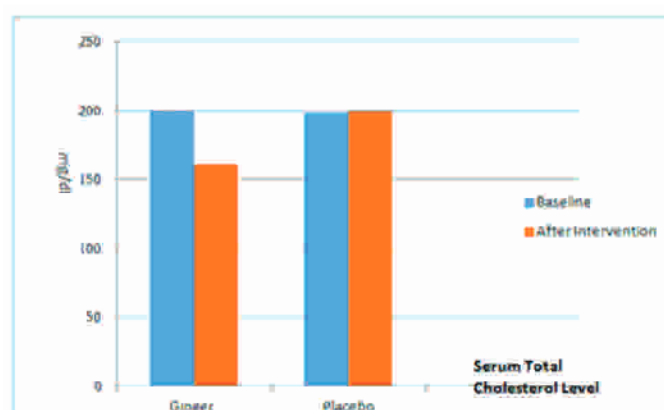
The present study was designed to evaluate the effect of administration of dried ginger powder (*Zingiber officinale*) in patients suffering from hyperlipidemia. Hyperlipidemia is a medical term for increased amount of lipids in plasma.¹ This is a condition of metabolism that can lead to so many diseases.¹⁷ If left untreated it can lead to coronary artery disease which can be fatal.⁷ The conditions include disorders

Figure: Graphical Representation of Effect of Treatment on Serum Total Cholesterol.

characterized by elevated blood cholesterol and triglycerides.⁵ Hyperlipidemia is highly prevalent in Pakistani population.⁶ As it is a modifiable risk factor

Table 1: Result of Treatment on Serum Total Cholesterol Level

Name of Parameter	Ginger (Treatment) Group		p-value	Result	Placebo Group		p-value	Result
	Baseline	After Treatment			Baseline	After Treatment		
	Mean \pm SEM	Mean \pm SEM			Mean \pm SEM	Mean \pm SEM		
Serum Total Cholesterol (mg/dl)	199.1 \pm 4.56	161.1 \pm 3.189	0.000	Highly significant	198.6 \pm 4.656	199.6 \pm 4.765	0.168	Not significant
Values are expressed as mean \pm S.E.M. and p-value less than or equal to 0.05 is considered significant.								



for coronary artery disease it desires improved control. For this, precautionary screening programs and changes in life style behaviors need to be stressed upon in community.¹⁸ Ginger (*Zingiber officinale*) is well reputed for its medicinal properties. Traditional herbal practitioners have used ginger for treatment of many diseases since ages.⁹ The conditions included infections, respiratory problems, headaches, morning sickness and elevated cholesterol levels.¹⁵ In the present study, a substantial decrease in serum cholesterol (p = value 0.000) was observed when hyperlipidemic patients were administered 3g of ginger per day. This confirms the findings of Alizadeh et al.¹⁶, whose studies showed a marked decrease in serum cholesterol after administration of ginger for 45 days. Also comparable is a study done by Li et al.²⁰ They observed the effect of 6-gingerol on hepatic cholesterol metabolism and its regulation at genetic level. Results showed that both cellular total cholesterol and free cholesterol decreased. It was found that 6-GN regulated cholesterol metabolism via up-regulation of LDLR through activation of SREBP2 as well as up-regulation of cholesterol efflux-related genes LXR α and ABCA1. This also correlates with another study²¹ who investigated the effects of ginger and rosemary oil on rats and them to be hypocholesterolaemic. Similarly another study²² done on rats showed that when ginger extract was administered intra-peritoneally or orally in a high dose (500mg/kg) for 4 weeks, it showed that serum cholesterol was reduced but triacylglycerol showed

no change. Ginger through its effect on genetic expression of various proteins improves lipid metabolism and reduces hyperlipidemia.²⁰ This lipid lowering effect of ginger is due to inhibition of cholesterol synthesis in the liver.¹⁵ The reduction in cholesterol levels has a positive correlation with enhanced excretion of faecal cholesterol and bile acids via up-regulation of hepatic CYP7A1 and down-regulation of mRNA of intestinal NPC1L1, ACAT2, and MTP.²³ Another way that we can explain the lipid lowering effect is that this can be due to activity of cholesterol- 7 α hydroxylase, which is a rate limiting enzyme of cholesterol biosynthesis. This increases the conversion of cholesterol to bile acids in the liver¹⁴ eventually lowering serum cholesterol. Ginger is also shown to possess cholesterol lowering capability due to its angiotensin converting enzyme activity.²⁴ However the results of the present study differ from Verma et al.²⁵ Verma and co workers showed that when dried ginger powder was administered in a dose of 0.1g/kg for 75 days to rabbits, this did not decrease blood lipids in cholesterol fed rabbits.

Conclusion

Ginger (*Zingiber officinale*) is reputed for its various medicinal properties. It had been used for the treatment of many ailments like high cholesterol levels, inflammation, asthma, migraine, morning sickness and infections. A lowering in serum total cholesterol level to a marked extent, by ginger consumed in a dose of 3g/day can play an important role in the prevention of diseases associated with it, like, cardiac complications and stroke.

Ethical Approval: Given

Conflict of Interest: None

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References

1. Mozaffarian, D. Benjamin, E.J. Go, A.S. Heart disease and stroke statistics—2016 update: a report from the American Heart Association. *Circulation*. 2016; 133(4): e38-e360.
2. Ma, H. Patti, M.E. Bile acids, obesity, and the

- metabolic syndrome. *Best Pract Res Clin Gastroenterol.* 2014;28:573–583.
3. Expert Dyslipidemia Panel of the International Atherosclerosis Society Panel members. An International Atherosclerosis Society Position Paper: global recommendations for the management of dyslipidemia—full report. *J Clin Lipidol* 2014; 8:29–60
 4. Berger S, Raman G, Vishwanathan R, Jacques PF, Johnson EJ. Dietary cholesterol and cardiovascular disease: a systematic review and meta-analysis. *Am J Clin Nutr.* 2015. 102(2):276-94. 24
 5. Nielsen, T.R. Thomsen, U.L. Fonvig, C. E. Holm, J.C. Dyslipidemia and reference values for fasting plasma lipid concentrations in Danish/North-European White children and adolescents. *BMC Pediatr.* 2017. 17: 116-118
 6. Chaudhry, M. A., Waseem, M., Ahmad, F., Ashraf, M. Z. Bhatti, A., Frequency of Coronary Heart Disease: Risk Factors among Doctors of CMH Lahore Medical and Dental College, Lahore – Pakistan. *A.P.M.C.*, 2012. 6: 2-4
 7. Andreadou, I. Iliodromitis, E. K. Lazou, A. Görbe, A. Giricz, Z. Schulz, R. et al. –Effect of hypercholesterolaemia on myocardial function, ischaemia-reperfusion injury and cardioprotection by preconditioning, postconditioning and remote conditioning. *Br J Pharmacol.* 2017. 174(12): 1555–1569.
 8. Levita, J. Syafitri, D.M. Supu, R.D. Mutakin, M. Megantara, S. Febrianti, M. et al. Pharmacokinetics of 10-gingerol and 6-shogaol in the plasma of healthy subjects treated with red ginger (*Zingiber officinale* var. *Rubrum*) suspension. *Biomed Rep* 2018. 9 (6):474-482.
 9. Wang, S. Zhang, C. Yang, G. Yang, Y. Biological properties of 6-gingerol: a brief review. *Nat Prod Commun.* 2014. Jul; 9(7):1027-30.
 10. Faraz, N. Khurram, Sehrish, S. Common human pathogens; antimicrobial role of ginger (*zingiber officinale*). *Professional Med J:* 2016. Dec - Dec; 23(12):1593-7.
 11. Ghafoor, K. Norulaini, N.A.N. Omar, A.K.M. Techniques for extraction of bioactive compounds from plant materials: A review. *Journal of Food Engineering* 2013. 117(4), 426–436.
 12. Viljoen, E. Visser, J. Koen, N. Musekiwa, A. A systematic review and meta-analysis of the effect and safety of ginger in the treatment of pregnancy-associated nausea and vomiting. *Nutr J.* 2014; 13: 20-21
 13. Azam, F. Abdulrahman, M. Abdullah, R. Mustafa, M. Ginger components as new leads for the design and development of novel multi-targeted anti-Alzheimer's drugs: a computational investigation. *Drug Des Devel Ther.* 2014; 8: 2045–2059.
 14. Tzeng, T.F. Liu, I.M. 6-Gingerol prevents adipogenesis and the accumulation of cytoplasmic lipid droplets in 3T3-L1 cells. *Phytomedicine.* 2014; 20(6):481-487.
 15. Carnuta, M.G. Deleanu, M. Barbalata, T. Toma, L. Raileanu, M. Sima, A.V. Stancu, C.S. Zingiber officinale extract administration diminishes steroyl-CoA desaturase gene expression and activity in hyperlipidemic hamster liver by reducing the oxidative and endoplasmic reticulum stress. *Phytomedicine.* 2018. 48:62-69.
 16. Alizadeh-Navaei, R., Roozbeh, F., Saravi, M., Pouramir, M., Jalali, F. Moghadamnia, A. A., Investigation of the effect of ginger on the lipid levels. A double blind controlled clinical trial. *S. M. J.*, 2008. 9: 1280-1284.
 17. Saadiq, F. Hyperlipidemia---Update & Review.[Internet] [Place Unknown] Cited 25 June 2013 Available from <<http://www.wfprofessional.com/documents/Hyperlipidemia-Update%20&%20Review-1.13.pdf>>
 18. Iqbal, S. P., Dodani, S., Qureshi, R. (2004). Risk factors and behaviours for coronary artery disease (CAD) among ambulatory Pakistanis. *J.P.M.A- n*, 54(5), 261-266.
 19. Zomrawi, W. Abdel Atti, K. Dousa, B. Mahala, A. The effect of ginger root powder (*Zingiber officinale*) supplementation on broiler chick's performance, blood and serum constituents. *Online J Anim Feed Res.* 2012. 2:457–460
 20. Li, X. Guo, J. Liang, N. Jiang, X. Song, Y. Ou, S. et al. 6-Gingerol Regulates Hepatic Cholesterol Metabolism by Up-regulation of LDLR and Cholesterol Efflux-Related Genes in HepG2 Cells. *Front Pharmacol.* 2018. 27(9):159.
 21. Eissa, F.A. Choudhry, H. Abdulaal, W.H. Baothman, O.A. Zeyadi, M. Moselhy, S.S. Possible hypocholesterolemic effect of ginger and rosemary oils in rats. *Afr J Tradit Complement Altern Med.* 2017.14(4):188-200.
 22. Thomson M, Al-Qattan KK, Al-Sawan SM, Alnaqeeb MA, Khan I, Ali M. The use of ginger (*Zingiber officinale* Rosc.) as a potential anti-inflammatory and antithrombotic agent. Prostaglandins, leukotrienes and essential fatty acids. 2002 Dec 1;67(6):475-8.
 23. Lei L, Liu Y, Wang X, Jiao R, Ma KY, Li YM, et al. Plasma cholesterol-lowering activity of gingerol- and shogaol-enriched extract is mediated by increasing sterol excretion. *J Agric Food Chem.* 2014. 62(43):10515-21.
 24. Akinyemi, A.J. Ademiluyi, A.O. Oboh, G. Inhibition of Angiotensin-1-Converting Enzyme Activity in High Cholesterol Fed Diet in Rats by Two Varieties of ginger (*Zingiber officinale*). *J. Med. Food.* 2014. 17(3):317-23.
 25. Verma, S. Singh, M. Jain, P. Bordia A., Protective effect of ginger, *Zingiber officinale* Rosc on experimental atherosclerosis in rabbits. *Indian. J. Exp. Biol.*, 2014. 42(7): 736-738.