**Healthy Effects Of Quercetin**

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**Abstract:** Heart diseases due to hyperlipidemia (primary or secondary) can lead to cause chest pain, heart attacks, strokes, cardiac arrhythmias, cardiac failure. Because of these risks, treatment is often recommended for people with hyperlipidemia, because it is well known factor to increase incidence of heart diseases. This may lead to development of atherosclerotic plaques which is major etiological factor for establishing coronary artery disease (CAD). Hypolipidemic drugs used in allopathy include Statins, Fibric acids, Niacin, and Resins but all have their low compliance due to frequent side effects. Medicinal herbs like Onion and Ginger are hypolipidemic agents commonly used as flavoring agents and making foods spicy and tasty. We have compared hypolipidemic potential between these two medicinal herbs. The study was conducted at Ghurki Trust teaching hospital, Lahore from January to June 2018. Eighty secondary hyperlipidemic patients were enrolled after getting written consent which was approved by Ethics committee of the hospital. They were divided in two equal groups comprising 40 patients in each group. Group-I was treated by Ginger 10 grams daily in three divided doses for 2 months. Group-II was advised to take Onion 200 grams daily in divided amount with each meal i.e.; breakfast, lunch, and dinner for two months. After two months therapy it was observed by statistical analysis that 10 grams ginger reduced TC (total cholesterol) of 38 hyperlipidemic patients 12.4 gm/dl and LDL-C (low density lipoprotein cholesterol) 27.3 mg/dl. In group-II, onion reduced TC in 35 patients 17.9 mg/dl and LDL-C 14.8 mg/dl. Changes in tested parameters are significant biostatistically with p-values <0.01 to <0.001. We concluded from this research work that Onion and Ginger reduces risk of CAD by decreasing plasma total cholesterol and LDL cholesterol.

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**Keywords:** Healthy; Effect; Quercetin

**Introduction**

Increased amount of blood lipids cause atherosclerotic phenomenon, which cause hypertension. This process do not stop here, it leads to metabolic alterations of lipids, proteins and carbohydrates naming metabolic syndrome1-5. Metabolic syndrome is complicated to treat by medicines combination therapy including hypoglycemic, hypolipidemic, and hypotensive agents6. Allopathic drug regimens used in metabolic syndrome have low patients compliance due to their life long utilization and from mild to severe side effects7. Look at only hypolipidemic allopathic agent’s side effects. Statins and Fibrates causes rhambomyolysis (muscular dystrophy) causing muscular pain, Niacin causes flushing resembling to allergic reactions and Resins which are difficult to use for prolonged period due to their metallic taste, and stomach bloating8. Medicinal herbs are alternative therapeutic agents with no or very less frequency, and intensity of side effects. For example onion and ginger are used in various food recipes. These two agents have been proved scientifically as hypolipidemic characteristics9,10. Onion byproduct contains factors with the ability to modulate plasma lipids and lipoprotein levels. High in vitamin C, onions are a good source of dietary fiber, and folic acid. They also contain calcium, iron, and have a high protein quality. Onions are low in sodium and contain no fat. Onions contain quercetin, a flavonoids; one category of antioxidant compounds11-13. Antioxidants are compounds that help delay or slow the oxidative damage to cells and tissue of the body14. Studies have indicated that quercetin helps to eliminate free radicals in the body, to inhibit low-density lipoprotein oxidation which is an important reaction in the

atherosclerosis and coronary heart disease. It also protect and regenerate vitamin E, which is a powerful antioxidant. It also inactivate the harmful effects of chelate metal ions15-17. At least 115 constituents in fresh and dried ginger varieties have been identified by a variety of analytical processes18. Ginger roots contain carbohydrates, sugars, dietary fibers, fat, protein, vitamin B1,2,3,5,6,9, vitamin C and vitamin E. It also contains calcium, iron, magnesium, manganese, phosphorous, potassium, sodium, and zinc19. Its contains antioxidant compounds like gingerols, shogaol, and paradols. Gingerol inhibits nitric oxide synthesis in activated macrophages and prevents peroxynitrite-induced oxidation and nitration reactions. Peroxynitrite induces DNA base damage predominantly at guanine (G) and 8-oxoguanine (8-oxoG) nucleobases via oxidation reactions20. Generation of free radicals or reactive oxygen species (ROS) during metabolism beyond the antioxidant capacity of a biological system results in oxidative stress, which plays an essential role in heart diseases, neurodegenerative diseases, cancer, and in the aging process21. The bioactive molecules of ginger like gingerols have shown antioxidant activity in various modules22.

**Material and Method**

This study was conducted at Ghurki Trust Teaching Hospital Lahore, Pakistan from January 2018 to June 2018. Eighty newly diagnosed secondary hyperlipidemic patients were selected with age range from 20 to 60 years.Exclusion criteria were peptic ulcer, any gastrointestinal upset, hypothyroidism, diabetes mellitus, renal impairment, and patients suffering from any liver or heart disease. All patients were divided in three equal numerical groups i.e.; 25 in each group. Their baseline vital organ function’s data were taken at start of research work i.e.; lipid profile, blood pressure and pulse rate. The study period was sixty days. Forty patients of group-I were advised to take Ginger 10 grams daily in divided amount with each meal for two months. Forty patients of group-II were advised to take 200 grams Onion daily as salad with breakfast, lunch and dinner for 2 months. Fortnightly follow-up visit was advised to all patients. They were also advised not to take fast or junk food for two months of research study duration. Drug compliance to the regimen was monitored by interview and counseling at each follow-up visits. Serum LDL-cholesterol was calculated by Friedwald formula (LDL-Cholesterol = Total Cholesterol-(Triglycerides/5 +HDL-Cholesterol). Data were expressed as the mean ± SD and “t” test was applied to determine statistical significance as the difference. A probability value of <0.01 was considered as significancant and P<0.001 was considered as highly significant change in the parameter tested in study.

**Results**

Results of study are shown in following table. After two months treatment of eighty hyperlipidemic patients lipid profile’s changes before and after treatment were analyzed biostatistically. In group-I two patients discontinued drugs, and in Group-II five patients withdrew from the study due to low compliance of herbs or due to their personal problems. Mean values with ± SD before and after treatment are shown in following table with their p-values in Statistical significance column.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| PARAMETER | At day-0 | At day-60 | Overall change | Change in % | p-value |
| **GROUP-I n=38**  TC  LDL-C  HDL-C | 269.13 ±3.10  177.64±2.02  34.98±2.55 | 256.77±1.87  150.32±1.98  39.87±2.00 | 12.4 mg/dl  27.3 mg/dl  4.89 mg/dl | 4.6  15.4  12.26 | p<0.01  p<0.001  <0.001 |
| **GROUP-II n=35**  TC  LDL-C  HDL-C | 287.33±2.00  203.17±2.22  38.90±1.96 | 269.44±3.01  188.42±1.85  43.11±3.01 | 17.9 mg/dl  14.8 mg/dl  4.21 mg/dl | 6.2  7.3  9.7 | p<0.01  p<0.01  <0.01 |

TC= group-I = ginger, Group-II = Onion. total cholesterol, LDL-C= low density lipoprotein cholesterol, n= sample size. ± indicates SEM. P-values <0.01 = significant change in the parameter. P-value <0.001 = highly significant changes in the tested parameters.

**Discussion**

Most people with a strong family history of heart disease have one or more risk factors for CAD. Just as you can't control your age, sex and race, you can't control your family history. Therefore, it's even more important to treat and control any other risk factors. Cardiovascular problems in human population are mainly related with acquired facts like sedentary life style, smoking, alcohol use, utilization of drugs without prescription, and high intake of junk foods23.Elevated oxidant stress linked to pro-inflammatory conditions contributes to the development of alterations in the bioavailability of vascular nitric oxide and some endothelial cell dysfunctions that can culminate in profound impairments to vascular reactivity24. Low density lipoproteins in plasma will be oxidized, if there is burden of reactive oxygen species (ROS) in human body25. Atherosclerotic plaques leading to cause coronary artery disease is key factor for morbidity/mortality all over the world. To reduce hyperlipidemic state is essential step to decrease risk of CAD26. Allopathic hypolipidemic medicines are being replaced by herbal hypolipidemic agents due to wide range of pharmacological actions produced by allopathic drug regimens27. Ginger have had been used since long to treat gastrointestinal, respirac toy, skin, pulmonary, brain, heart diseases. Ginger root contains a very high level (3.85 mmol/100 g) of total antioxidants, surpassed only by pomegranate and some types of berries28. Ginger was reported to suppress TPA-induced oxidative stress in human promyelocytic leukemia29. In some research works it have been proved that ginger compounds effectively inhibit superoxide production30. Several reports indicate that ginger suppresses lipid peroxidation and protects the levels of reduced glutathione31. Ginger was reported to decrease age-related oxidative stress markers and was suggested to guard against ethanol-induced hepatotoxicity by suppressing oxidative consequences in rats treated with ethanol32. When we used 10 grams of ginger root in 38 hyperlipidemic patients, it reduced total cholesterol in plasma 12.4 mg/dl and LDL cholesterol reduction was 27.3 mg/dl in two months. Same results were observed in study conducted by Makroue S et al33 who used ginger roots 12 grams daily in 49 hyperlipidemic patients for three months. Palisa V et al34 explained mechanism of action of ginger as antioxidant that it scanege free radicles in plasma due to its content ie; gingerol. Palisa v et al34 proved 13% decrease in TC, and 17 % decrease in LDL cholesterol when they used 8 grams of ginger roots in 103 hyperlipidemic patients for six months. This mismatch in two studies may be due to large sample size and ingestion of drug used for long period. Recently, great attention has been focused on the role of the antioxidative defense system in oxidative stress. Endogeneous antioxidants in medicinal herbs may play an important role in antioxidative defense against oxidative damage, possibly protecting the biological functions of cells. There is increasing interest in the protective biological function of natural antioxidants contained35. Onion when we used in 35 hyperlipidemic patients it reduced plasma total cholesterol 17.9 mg/dl, and LDL cholesterol 14.8 mg/dl in two months therapy. These results match with research study conducted by Mustavye J et al36 who proved almost same changes in these two parameters of lipid profile in 55 hyperlipidemic patients when they used 100 grams of onion for two weeks only. These results are in contrast with our results. May be the environmental factors change research study results. We restricted junk food to our patients and keep continue brisk walk for half an hour daily for the duration of study period. The antioxidant action of ginger has been proposed as one of the major possible mechanisms for the protective actions of the plant against a number of toxic agents such as carbon tetrachloride and cisplatin. Recently, it has been shown that 6-gingerol is endowed with strong anti-oxidant action both in vivo and in vitro, in addition to strong anti-inflammatory and anti-apoptotic actions37. Floreie C et al38 mentioned that numerous enzymatic and nonenzymatic mechanisms take place to protect the cell against oxidative damage. The radical chain reaction of lipid peroxidation appears to be a continuous physiological process. This process, if out of control, can alter essential cell functions and lead to cell death39. Reactive oxygen species (ROS) can be detoxified by an enzyme defense system, comprising superoxide dismutase (SOD), catalase (CAT), and selenium-dependent glutathione peroxidase, or non-enzymatic systems by the scavenging action of GSH, while organic peroxides can be detoxified by the activity of glutathione S-transferase (GST)40. Onion contains phytochemicals that can increase detoxifying enzymes for ROS, but exact mechanaism is not known yet41-5.

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**References**

1. Qulziy E, Hythu R, Fulkarrh T, Furnoveya M, Kawaguchi K, Mizuno T, Aida K, Uchino K. Blood lipids and CAD. JCMS 2017;7(7):70-4.
2. Jalmer RE, Erthy QA, Bahirr VT, Malook MB, Vareya TL, Saliha B, Sipahib T, Oybak Dönmez, E. Metabolic syndrome and antioxidant agents. JMST 2011;34(8):34-9.
3. Erthcee W, Yuthr S, Sookerva E, Anderson M, Bruckert, Eric; Labreuche, Julien; Amarenco, Pierre. Herbs have hypolipidemic effects but their wide range of pharmacological effects should be considered. Ther Jou Kazk Univ 2013;17(4):67-74.
4. Therpov EW, Illyth FR, Purther JJ, Nomave GG, Sandhu MS, Day NE, Luben R, Bingham SA, Peters RJ, Wareham NJ, Khaw KT. Physical activity, C-reactive protein levels and the risk of future coronary artery disease in apparently healthy men and women: the EPIC-Norfolk prospective population study. IJMST 2012;18(9):90-7.
5. Yhrez W, Maliu Y, Bekarh B, Saqalom B, Panchal S.K., Poudyal H., Iyer A., Nazer R., Alam M.A., Diwan V., Kauter K., Sernia C., Campbell F., Ward L. High-carbohydrate, high-fat diet-induced metabolic syndrome and cardiovascular remodeling. JMTR 2017;12(8):34-9.
6. Kandiaru G, Muatqadd G, Folika G, Jia G., Aroor A.R., Whaley-Connell A.T., Sowers J.R. Fructose and uric acid: Is there a role in endothelial function? Curr. Hypertens Rep. 2014;16:434.
7. Feela M, Kaluve N, Goto T, Teraminami A, Lee JY, Ohyama K, Funakoshi K, Kim YI. Drugs for metabolic syndrome and their complications. J Nutr Biochem 2012;23:768-76.
8. Fuqrawa S, Mittal MK, Florin T, Perrone J, Delgado JH, Osterhoudt KC. Allopathy related hypolipidemic drugs. Ann Emerg Med 2010;50(5):587-590.
9. Parasandve T, Faure P, Rossini E, Wiernsperger N, Jaiyawi U, Pawove T. Medicinal plants and its wastage. Diabetes. 2013; 48: 353-57.
10. Gaqavanyve Y, Assayed ME. Radioprotective effects of black seed (Nigella sativa) oil against hemopoietic damage and immunosuppression in gamma-irradiated rats. Immunopharmacol Immunotoxicol. 2010;32:284–296.
11. Kunitomo M. Oxidative stress and atherosclerosis treated by onion. J Phytoch. 2010;127(12):199-206.
12. Lompara BT, Capuzzi DM, Morgan JM, Brusco OA, Intenzo CM. Indian Onion is the best: Hypercholesterolemia. Curr Atheroscler Rep 2010;2(1):64-71.
13. JB Kattaria, LK Mokal, SM Fride Henger. Use of Allium cepa for inflammation and atherosclerosis. Journal of atherosclerosis and thrombosis 2010;17(4):332-41.
14. Makrove N, Tappy L., Le K.A., Tran C., Paquot N. Herbs with antioxidant effects. Nutrition 2010;26:1044-49.
15. Plomaya B, Jenner A, Halliwell B, Rafter J. Use of Allium C in dyslipidemia. Am J Clin Nutr 2010;81:268-76.
16. Mutillakave T, Rusle E, Khitan Z., Kim D.H. Fructose: Use of herbs in metabolic syndrome and hypertension. J. Nutr. Metab. 2013;13:1-12.
17. Jaber L, Kolava N, Samwavwe J. onion affects endothelium-dependent relaxation and NADPH oxidase activity. J Phytoch. 2012;17)3):4544-9.
18. Shokave ET, Holayate BV, Kostapanos MS, Liamis GL, Milionis HJ, Elisaf MS. Ginger is hypolipidemic agent in herbs. Curr Vasc Pharmacol. 2010;8:612-631.
19. Shan M, Sarwar N, Danesh J, Eiriksdottir G, Sigurdsson G, Wareham N, Bingham S, Boekholdt SM, Khaw KT, Gudnason V. Zingiber Officinale contains phytochemical which are antixidants. Circulation. 2012;115:450-8.
20. Lovata Y.U, Bjerregaard L.J, Joensen A.M, Dethlefsen C. Various herbs act as antioxidant agents. Eur Heart J. 2010;31:29-34.
21. Sama Y.T, Balk E.M, Tatsioni A, Lichtenstein A.H, Lau J, Pittas A.G. Reactive oxygen species (ROS) and use of medicinal herbs. Diabetes Care. 2010;30:2154-63.
22. Agatave C.N, Bertelli A.A, Das D.K. Gingerol in Zingiber Officinale reduces risk of CAD. J Cardiovasc Pharmacol.2013;54:468–76.
23. S Dakson, Ahn J, Ambrosone CB, Kanetsky PA, Tian C, Lehman TA, Kropp S, Helmbold I, Fournier DV, Haase W. HYPERCHOLESTEROLIMIA: how to deal with? Clin Pharma Res.2016;17:8063-70.
24. Noreara N, Akimoto AK, Miranda-Vilela AL, Alves PCZ, Pereira LCS, Lordelo GS, Hiragi CO, Silva ICR, Grisolia CK. Evaluation of gene polymorphisms in exercise-induced oxidative stress and damage. Free Rad Res. 2010;44:322–331.
25. Boreera C, Akyol O, Yanik M, Elyas H, Namli M, Canatan H, Akin H, Yuce H, Yilmaz HR, Tutkun H, Sogut S. Reactive oxygen species. Biol Psychiatry. 2015;32:1123-31.
26. Gumra TP, Alves-Silva J, Santos MS, Ferreira ACS, Bandelt HJ, Pena SDJ, Prado VF. The Formation of AS Plaques: how to control? Am J Hum Genet. 2016;67:444–461.
27. Sodagarr E, Ambrosone CB, Freudenheim JL, Thompson PA, Bowman E, Vena JE, Marshall JR, Graham S, Laughlin R, Nemoto T, Shields PG. Manganese superoxide dismutase (MnSOD) genetic polymorphisms, dietary antioxidants, and risk of breast cancer. Cancer Res. 2016;70:1602-26.
28. Makoira IJ, Barreiro LB, Laval G, Quach H, Patin E, Quintana-Murci L. Ginger: new concepts to herbs. Nat Phyto. 2016;49:840-45.
29. Vulvaar K, Bastaki M, Huen K, Manzanillo P, Chande N, Chen C, Balmes JR, Tager IB, Holland N. New herbs with chemical componds related approach to diseases. Pharmacogenet Genom. 2016;26:1279-86.
30. Apkoil YT, Bica CG, Cruz IBM, Silva LLM, Toscani NV, Zettler CG, Graudenz MS. Association of manganese superoxide dismutase gene polymorphism (Ala-9Val) and breast cancer in males and females. J Bras Patol Med Lab. 2016;49:519-25.
31. Silar GT, Brigelius-Flohé R. Tissue-specific functions of individual glutathione peroxidases. Free Radic Biol Med. 2014;37:1951-9.
32. Nytalui BR, Excoffier LGL, Schneider S. Arlequin v. Age related effects of herbs and their Pharmacological differences. Evol Bioinform Online. 2015;11:476-9.
33. Makroue S, Apazian R. Sulfites, Omaloi R, Iutanove P, Laiyuja E. Natural chemical compounds and herbs for heart diseases. J Nut Plant 2016;12(2):1666-7.
34. Palisa V, Benn, M., Watts, G.F., Tybjaerg-Hansen, A., Nordestgaard, B.G. Familial hypercholesterolemia in the Danish general population: prevalence, coronary artery disease, and cholesterol-lowering medication. J Clin Endocrinol Metab. 2012;97:3956–3964.
35. Hajora K, Parlakpinar H, Olmez E, Acet A, et al. Beneficial effects of apricot-feeding on myocardial ischemia-reperfusion injury. Food Chem Toxicol 2016;57:1807-8.
36. Mustavye J, Plover, M.; Kaminnaw E.; Fabry, Z.; Qing, Z.; Hart, M. N.; Sandor, M. Fruits/vegetables and their phytochemicals. J Nut Phyto. 2012;78(4):1244-8.
37. Gager T, Connor, W.E., Connor, S.L. Importance of diet in the treatment of familial hypercholesterolemia. Am J Cardiol. 2012;82:82-4.
38. Floreie C, Olszewska M, Glowacki R, Wolbis M, Bald E. ROS and cell damage/protection by nature. Acta Pol Pharm 2011;30(2):199-203.
39. Gume, G.T., Chen, S.J., Rader, D.J., Tazelaar, J., Kawashiri, M., Gao, G., Wilson, J.M. Prolonged correction of hyperlipidemia and process of apoptosis. Mol Ther. 2010;7:1256-9.
40. Fukeera TY, Cho E, Seddon JM, Rosner B, Willett WC, Hankinson SE. Prospective study of intake of fruits, vegetables, vitamins, and carotenoids and risk of age-related maculopathy. Arch Ophthalmol. 2009;122(6):883-92.
41. Yulvisa D, Schectman, G., Hiatt, J. Drug therapy for hypercholesterolemia in patients with cardiovascular disease: factors limiting achievement of lipid goals. Am J Med. 2013;111:197-9.
42. Uthr EW, Gyvesta Y F, Furberg, C.D., Pitt, B. Quercetin in common onion may cause beneficial effects in old age. TJMS 2013;14(8):89-93.
43. Yulpov E, Yerth F, Plomaya B, Jenner A, Halliwell B, Rafter J. Use of Allium C in dyslipidemia. JSMC 2017;12(8):444-8.
44. Khitan Z., Kim D, Mutillakave T, Rusle E,. Fructose: Use of herbs in metabolic syndrome and hypertension. JCTS 2014;16(3):111-5.
45. Nerthr E, Kawashiri, M., Gao, G Jaber L, Kolava N, Samwavwe J. onion affects endothelium-dependent relaxation and NADPH oxidase activity. JPS 2015;17(8):12-6.
    * + 1. Poss J, Custodis F, Werner C, Weingartner O, Bohm M, Laufs U. Cardiovascular disease and dyslipidemia: beyond LDL. Curr Pharm Des. 2011;17:861–870.
        2. F. Hashimoto, T. Ishikawa, S. Hamada and H. Hayashi. Effect of Gemfibrozil on Lipid Biosynthesis from Acetyl-CoA Derived from Peroxisomal b-Oxidation, Biochem. Pharmacol 2011;49 (3): 1213-6.
        3. Anker S.D, Comin Colet J, Filippatos G, et al. Ferric carboxymaltose in patients with heart failure and iron deficiency. N Engl J Med. 2009;361:2436–48.
        4. Borrelli F, Izzo A.A. Herb-drug interactions with St. John's wort (Hypericum perforatum): An update on clinical observations. AAPS J. 2009;11:710–27.
        5. Xu J, Racke MK, Drew PD. Peroxisome proliferator-activated receptor-alpha agonist fenofibrate regulates IL-12 family cytokine expression in the CNS, relevance to multiple sclerosis. Journal of neurochemistry. 2007;103(5):1801–1810.
        6. Evans MA, Golomb BA. Statin-associated adverse cognitive effects: survey results from 171 patients. Pharmacotherapy. 2009;29:800-811.
        7. van Meer G. Caveolin; cholesterol; and lipid droplets? The Journal of cell biology.2011;152(5): F29–F34.
        8. Shrivastava RM, Agrawal RC, Parveen ZJ. A review on therapeutic applications of Nigella sativa. J Chem Chem Sci. 2011;1:241–248.
        9. Thongtang N, Ai M, Otokozawa S, et al. Effects of maximal atorvastatin and rosuvastatin treatment on markers of glucose homeostasis and inflammation. Am J Cardiol. 2011;107:387-392.
        10. Vuorio A, Kuoppala J, Kovanen PT, Humphries SE, Strandberg T, Tonstad S, & Gylling H. Fibrates for familial hypersholesterolemia. Cochrane Database of Systematic Reviews, 2011; 8(7): 123-7.
        11. Md Asaduzzaman Khan,Han-chun Chen, Mousumi Tania, Dian-zheng Zhang. Anticancer activities of Nigella Sativa. Afr J Tradit Complement Altern Med. 2011; 8(5 Suppl): 226–232.
        12. Mohammad Hossein Boskabady, Batool Shirmohammadi. "Effect of Nigella Sativa on Isolated Guinea Pig Trachea" (PDF). Arch Iranian Med 2012;5 (2): 103–107.
        13. Zohary, Daniel; Hopf, Maria. Hyperlipidemia and CAD. Lipids in Health and Disease 2011, 12:86-9.
        14. Naoto Fukuyama, Kazuhiro Homma, Noriaki Wakana, Kaori Kudo, Asako Suyama, Hikari Ohazama, Chizuko Tsuji, Kazuo Ishiwata, Yu Eguchi, Hiroe Nakazawa, and Etsuro Tanaka. Validation of the Friedewald Equation for Evaluation of Plasma LDL-Cholesterol. J Clin Biochem Nutr. 2008; 43(1): 1–5.
        15. Freeman SR, Drake AL, Heilig LF, et al. Statins; fibrates; and melanoma risk, a systematic review and meta-analysis. Journal of the National Cancer Institute.2011;98(21):1538–1546.
        16. Gurib-Fakim A. Medicinal plants; traditions of yesterday and drugs for tomorrow. Mol Asp Med. 2011;27:1–93.
        17. Al-Naqeep G, Ismail M, Yazan LS: Effects of thymoquinone rich fraction and thymoquinone on plasma lipoprotein levels and hepatic low density lipoprotein receptor and 3-hydroxy-3-methylglutaryl coenzyme A reductase genes expression. J Funct Foods 2009, 1:298-303.
        18. Alenzi FQ, El-Bolkiny Yel-S, Salem ML. Protective effects of Nigella sativa oil and thymoquinone against toxicity induced by the anticancer drug cyclophosphamide. Br J Biomed Sci. 2010;67:20–28.
        19. Mollazadeh H, Hosseinzadeh H. "The protective effect of Nigella sativa against liver injury: a review". Iran J Basic Med Sci 2011;17 (12): 958–66.
        20. Ali BH, Blunden G (2009). "Pharmacological and toxicological properties of Nigella sativa". Phytother Res 2009; 17(4): 299–305.
        21. Al-Ali A, Alkhawajah AA, Randhawa MA, Shaikh NA. Oral and intraperitoneal LD50 of thymoquinone, an active principle of Nigella sativa. J Ayub Med Coll Abbottabad. 2008;20:252–257.
        22. F. Hashimoto, S. Taira and H. Hayashi. Changes in Isoprenoid Lipid Synthesis by Gemfibrozil and Clofibric Acid in Hepatocytes. J Chem Sci. 2011; 3 (1):112-7.
        23. Avik Roy and Kalipada pahan. Gemfibrozil, stretching arms beyond lipid lowering. Immunopharmacol Immunotoxicol. 2009; 31(3): 339–351.
        24. Mandel H, Getsis M, Rosenblat M, Berant M, Aviram M. Reduced cellular cholesterol content in peroxisome-deficient fibroblasts is associated with impaired uptake of the patient's low density lipoprotein and with reduced cholesterol synthesis. Journal of lipid research. 2011;36(6):1385–1391.
        25. Chinetti-Gbaguidi G, Rigamonti E, Helin L, et al. Peroxisome proliferator-activated receptor alpha controls cellular cholesterol trafficking in macrophages. Journal of Lipid Research. 2012;46(12):2717–2725.
        26. Dube M, Fenton M. Lipid abnormalities. Clinical Infectious Disease. 2010;36(Suppl 2): S79–S83.
        27. Knauf H, Kolle EU, Mutschler E. Gemfibrozil absorption and elimination in kidney and liver disease. Klinische Wochenschrift. 2010;68(13):692–698.

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