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Original Research Article

Ginger and Onion: Pakistani Herbs to be used in Treating Hyperlipidemia and Oxidative Stress

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Abstract: Dyslipidemia 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 2016. 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.

Keywords: Ginger, Onion, Hyperlipidemia, Oxidative Stress.

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INTRODUCTION

Metabolic syndrome is not a single disease, rather complication of three diseases ie; hyperlipidemia, hypertension, and diabetes mellitus. 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 syndrome [1- 5]. Metabolic syndrome is complicated to treat by medicines combination therapy including hypoglycemic, hypolipidemic, and hypotensive agents [6]. Allopathic drug regimens used in metabolic syndrome have low patients compliance due to their life long utilization and from mild to severe side effects [7]. 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

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difficult to use for prolonged period due to their metallic taste, and stomach bloating [8]. 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 characteristics [9, 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 compounds [11-13]. Antioxidants are compounds that help delay or slow the oxidative damage to cells and tissue of the body [14]. 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 ions [15-17]. At least 115 constituents in fresh and dried ginger varieties have been identified by a variety of analytical processes [18]. 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 zinc [19]. 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 reactions [20]. 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 process [21]. The bioactive molecules of ginger like gingerols have shown antioxidant activity in various modules [22].

MATERIAL AND METHOD

This study was conducted at Ghurki Trust Teaching Hospital Lahore, Pakistan from January 2016 to June 2016. 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.

Group and parameters	At day-0	At day-60	Overall change	Change in %	p-value
GROUP-I n=38					
TC	269.13 ±3.10	256.77±1.87	12.4 mg/dl	4.6	p<0.01
LDL-C	177.64±2.02	150.32±1.98	27.3 mg/dl	15.4	p<0.001
GROUP-II n=35					
TC	287.33±2.00	269.44±3.01	17.9 mg/dl	6.2	p<0.01
LDL-C	203.17±2.22	188.42±1.85	14.8 mg/dl	7.3	p<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

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 foods [23]. 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 reactivity [24]. Low density lipoproteins in plasma will be oxidized, if there is burden of reactive oxygen species (ROS) in human body [25]. 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 CAD [26]. Allopathic hypolipidemic medicines are being replaced by herbal hypolipidemic agents due to wide range of pharmacological actions produced by allopathic drug regimens [27]. 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 berries [28]. Ginger was reported to suppress TPA-induced oxidative stress in human promyelocytic leukemia [29]. In some research works it have been proved that ginger compounds effectively inhibit superoxide production [30]. Several reports indicate that ginger suppresses lipid peroxidation and protects the levels of reduced glutathione [31]. 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 ethanol [32]. 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 al*., [33], who used ginger roots 12 grams daily in 49 hyperlipidemic patients for three months. Palisa V *et al*., [34], explained mechanism of action of ginger as antioxidant that it scanege free radicles in plasma due to its content ie; gingerol. Palisa v *et al*., [34], 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 contained [35]. 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 al*., [36], 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 actions [37]. Floreie C *et al*., [38], 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 death [39]. 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 yet [41]. A group of volunteers fed a high fat diet plus 100 g onion once a day and those fed fat diet only showed a significant decrease in serum triglycerides, but not cholesterol, as compared to those only fed with fat diet only. Another study reported that oral administration of a butanol onion extract to patients with elementary lipemia prevented an increase in total serum cholesterol, Jlipoprotein cholesterol, and J-lipoprotein and serum triglycerides. Gyvesta YF *et al*., [42], described that quercetin (one of the content of onion) has been shown to have antioxidant activity related to a strong scavenging capacity. Various studies have had proved fundamental use of phytochemical to reduce risk for coronary artery diseases as mentioned by Noor M *et al*., [43]. Jan MM *et al*., [44], proved same effects of onion extracts used in rats and found this phytochemical quercetin (present in onion) as potent as statins as hypolipidemic agent. Fovuca M *et al*., [45], explained that onion is natural antioxidant plant and it works as modulator of detoxification in human population.

CONCLUSION

It was concluded from this work that medicinal plants can be used with good compliance to reduce high plasma lipids leading to reduce incidence of coronary artery diseases (CAD).

REFERENCES

1. Polay, T. R., Bahirr, V. T., Malook, M. B., Vareya, T. L., Saliha, B., Sipahib, T., & Oybak Dönmez, E. (2011). Metabolic syndrome and antioxidant agents. *Journal of Ethnopharmacology*, *124*(3), 416-420.
2. Sookerva, E., Anderson, M., Bruckert, E., Labreuche, J., & Amarenco, P. (2010). Herbs have hypolipidemic effects but their wide range of pharmacological effects should be considered. *Atherosclerosis*, *21*(2), 353-61.

3. Nomave, G. G., Sandhu, M. S., Day, N. E., Luben, R., Bingham, S. A., Peters, R. J., Wareham, N. J, & Khaw, K. T. (2015). 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. *Eur J Cardiovasc Prev Rehabil, 13*(6), 970-6.
4. Fulkarrh, T., Furnoveya, M., Kawaguchi, K., Mizuno, T., Aida, K., & Uchino K. (2011). *Blood lipids and CAD. Biosci Biotechnol Biochem, 61*, 102-4.
5. 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. (2011). High-carbohydrate, high-fat diet-induced metabolic syndrome and cardiovascular remodeling. *J. Cardiovasc. Pharmacol, 57*, 611-24.
6. Muatqadd, G., Folika, G., Jia, G., Aroor, A. R., Whaley-Connell, A. T., & Sowers, J. R. (2014). Fructose and uric acid: Is there a role in endothelial function? Curr. *Hypertens Rep, 16*, 434.
7. Feela, M., Kaluve, N., Goto, T., Teraminami, A., Lee, J. Y., Ohyama, K., ... & Kim, Y. I. (2012). Drugs for metabolic syndrome and their complications. *J Nutr Biochem*, *23*, 768-76.
8. Fuqrawa, S., Mittal, M. K., Florin, T., Perrone, J., Delgado, J. H., & Osterhoudt, K. C. (2010). Allopathy related hypolipidemic drugs. *Ann Emerg Med*, *50*(5), 587-590.
9. Parasandve, T., Faure, P., Rossini, E., Wiernsperger, N., Jaiyawi, U., & Pawove, T. (2013). Medicinal plants and its wastage. *Diabetes, 48*, 353-57.
10. Gaqavanyve, Y., & Assayed, M. E. (2010). Radioprotective effects of black seed (Nigella sativa) oil against hemopoietic damage and immunosuppression in gamma-*irradiated rats.Immunopharmacol Immunotoxicol, 32*, 284–296.
11. Kunitomo, M. (2010). Oxidative stress and atherosclerosis treated by onion. *J Phytoch*, *127*(12), 199-206.
12. Lompara, B. T., Capuzzi, D. M., Morgan, J. M., Brusco, O. A., & Intenzo, C. M. (2010). Indian Onion is the best: Hypercholesterolemia. *Curr Atheroscler Rep*, *2*(1), 64-71.
13. Kattaria, J. B., Mokal, L. K., & Henger, S. F. (2010). Use of Allium cepa for inflammation and atherosclerosis. *Journal of atherosclerosis and thrombosis*, *17*(4), 332-41.
14. Makrove, N., Tappy, L., Le, K. A., Tran, C., & Paquot, N. (2010). Herbs with antioxidant effects. *Nutrition, 26*, 1044-49.
15. Plomaya, B., Jenner, A., Halliwell, B., & Rafter, J. (2010). Use of Allium C in dyslipidemia. *Am J Clin Nutr, 81*, 268-76.
16. Mutillakave, T., Rusle, E., Khitan, Z., & Kim, D. H. (2013). Fructose: Use of herbs in metabolic syndrome and hypertension. *J. Nutr. Metab, 13*, 1-12.
17. Jaber, L., Kolava, N., & Samwavwe, J. (2012). onion affects endothelium-dependent relaxation and NADPH oxidase activity. *J Phytoch*, *17*(3), 4544-9.
18. Shokave, E. T., Holayate, B. V., Kostapanos, M. S., Liamis, G. L., Milionis, H. J., & Elisaf, M. S. (2010). Ginger is hypolipidemic agent in herbs. *Curr Vasc Pharmacol*, *8*, 612-631.
19. Shan, M., Sarwar, N., Danesh, J., Eiriksdottir, G., Sigurdsson, G., Wareham, N., ... & Gudnason, V. (2012). Zingiber Officinale contains phytochemical which are antixidants. *Circulation*, *115*, 450-8.
20. Lovata, Y. U., Bjerregaard, L. J., Joensen, A. M., & Dethlefsen, C. (2010). Various herbs act as antioxidant agents. *Eur Heart J*, *31*, 29-34.
21. Sama, Y. T., Balk, E. M., Tatsioni, A., Lichtenstein, A. H., Lau, J., & Pittas, A. G. (2010). Reactive oxygen species (ROS) and use of medicinal herbs. *Diabetes Care*, *30*, 2154-63.
22. Agatave, C. N., & Bertelli, A. A. (2013). Das DK Gingerol in Zingiber Officinale reduces risk of CAD. *J Cardiovasc Pharmacol*, *54*, 468-76.
23. Dakson, S., Ahn, J., Ambrosone, C. B., Kanetsky, P. A., Tian, C., Lehman, T. A., ... & Haase, W. (2016). HYPERCHOLESTEROLIMIA: how to deal with. *Clin Pharma Res*, *17*, 8063-70.
24. Noreara, N., Akimoto, A. K., Miranda-Vilela, A. L., Alves, P. C. Z., Pereira, L. C. S., Lordelo, G. S., Hiragi, C. O., Silva, I. C. R., Grisolia, C. K. (2010). Evaluation of gene polymorphisms in exercise-induced oxidative stress and damage. *Free Rad Res, 44*, 322–331.
25. Boreera, C., Akyol, O., Yanik, M., Elyas, H., Namli, M., Canatan, H., ... & Sogut, S. (2015). Reactive oxygen species. *Biol Psychiatry*, *32*, 1123-31.
26. Gumra, T. P., Alves-Silva, J., Santos, M. S., Ferreira, A. C. S., Bandelt, H. J., Pena, S. D. J., & Prado, V. F. (2016). The Formation of AS Plaques: how to control. *Am J Hum Genet, 67*, 444-461.
27. Sodagarr, E., Ambrosone, C. B., Freudenheim, J. L., Thompson, P. A., Bowman, E., Vena, J. E., Marshall, J. R., Graham, S., Laughlin, R., Nemoto, T., & Shields, P. G. (2016). Manganese superoxide dismutase (MnSOD) genetic polymorphisms, dietary antioxidants, and risk of breast cancer. *Cancer Res, 70*, 1602-26.
28. Makoira, I. J., Barreiro, L. B., Laval, G., Quach, H., Patin, E., & Quintana-Murci, L. (2016). Ginger: new concepts to herbs. *Nat Phyto*, *49*, 840-45.
29. Vulvaar, K., Bastaki, M., Huen, K., Manzanillo, P., Chande, N., Chen, C., ... & Holland, N. (2016). New herbs with chemical componds related approach to diseases. *Pharmacogenet Genom*, *26*, 1279-86.
30. Apkoil, Y. T., Bica, C. G., Cruz, I. B. M., Silva, L. L. M., Toscani, N. V., Zettler, C. G., & Graudenz, M. S. (2016). Association of manganese superoxide dismutase gene polymorphism (Ala-9Val) and breast cancer in males and females. *J Bras Patol Med Lab*, *49*, 519-25.
31. Silar, G. T., & Brigelius-Flohé, R. (2014). Tissue-specific functions of individual glutathione peroxidases. *Free Radic Biol Med, 37*, 1951-9.
32. Nytalui, B. R., Excoffier, L. G. L., & Schneider, S. (2015). Arlequin v. Age related effects of herbs and their Pharmacological differences. *Evol Bioinform Online*, *11*, 476-9.

33. Makroue, S., Sulfites, A. R., Omaloi, R., Iutanove, P., & Laiyuja, E. (2016). Natural chemical compounds and herbs for heart diseases. *J Nut Plant*, *12*(2), 1666-7.
34. Palisa, V., Benn, M., Watts, G. F., Tybjaerg-Hansen, A., & Nordestgaard, B. G. (2012). Familial hypercholesterolemia in the Danish general population: prevalence, coronary artery disease, and cholesterol-lowering medication. *J Clin Endocrinol Metab*, *97*, 3956–3964.
35. Hajora, K., Parlakpinar, H., Olmez, E., & Acet, A. (2016). Beneficial effects of apricot-feeding on myocardial ischemia-reperfusion injury. *Food Chem Toxicol*, *57*, 1807-8.
36. Mustavye, J., Plover, M., Kaminnaw, E., Fabry, Z., Qing, Z., Hart, M. N., & Sandor, M. (2012). Fruits/vegetables and their phytochemicals. *J Nut Phyto*, *78*(4), 1244-8.
37. Gager, T., Connor, W. E., & Connor, S. L. (2012). Importance of diet in the treatment of familial hypercholesterolemia. *Am J Cardiol*, *82*, 82-4.
38. Floreie, C., Olszewska, M., Glowacki, R., Wolbis, M., & Bald, E. (2011). ROS and cell damage/protection by nature. *Acta Pol Pharm*, *30*(2), 199-203.
39. Gume, G. T., Chen, S. J., Rader, D. J., Tazelaar, J., Kawashiri, M., Gao, G., & Wilson, J. M. (2010). Prolonged correction of hyperlipidemia and process of apoptosis. *Mol Ther*, *7*, 1256-9.
40. Fukeera, T. Y., Cho, E., Seddon, J. M., Rosner, B., Willett, W. C., & Hankinson, S. E. (2009). Prospective study of intake of fruits, vegetables, vitamins, and carotenoids and risk of age-related maculopathy. *Arch Ophthalmol*, *122*(6), 883-92.
41. Yulvisa, D., Schectman, G., & Hiatt, J. (2013). Drug therapy for hypercholesterolemia in patients with cardiovascular disease: factors limiting achievement of lipid goals. *Am J Med*, *111*,197-9.
42. Gyvesta, Y. F., Furberg, C. D., & Pitt, B. (2011). Quercetin in common onion may cause beneficial effects in old age. *Curr Control Trials Cardiovasc Med*, *9*, 1205-7.
43. Noor, M., Furkan, A., Mohammad, A., Shah, M., & Shah, N. (2014). Miraculos hypolipidemic plants in Pakistan. *J Cl Med*, *12*(2), 334-9.
44. Jan, M. M., Fohsin, J. J., Lukver, T. T., Dohmerve, V. T., & Ginsovonenn, G. F. (2013). Onion is best plant to treat hyperlipidemia in albino rats. *EJM*, *2*(4), 1123-8.
45. Fovuca, M., Sulmin, S., Kovachi, F., & Dulhinn, D. (2013). Hypolipidemic effects of various plants. *EJ Cl Cardiol*, *7*(7), 435-9.