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Modulation of blood pressure, lipid profiles and redox status in hypertensive patients taking different edible oils

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Abstract

Background: Free oxygen radicals and insufficiency of antioxidants have been implicated in the pathogenesis of hypertension. We determined the effect of edible oils on blood pressure, lipid profiles and redox status in hypertensive patients given antihypertensive therapy (nifedipine–calcium channel blocker).
Methods: 530 patients medicated with nifedipine were divided into 3 groups (356 patients–sesame oil; 87 patients–sunflower oil; 47 patients–groundnut oil) and the control group (n=40) received only the drug, nifedipine. The respective oils were supplied to the patients and instructed to use as the only edible oil for 60 days, which comes to 35 g of oil/day/person. Blood pressure, lipid profiles [total cholesterol (TC), low density lipoprotein cholesterol (LDL-C), high density lipoprotein cholesterol (HDL-C) and triglycerides (TG)], lipid peroxidation [thiobarbituric acid reactive substances (TBARS)], enzymatic [superoxide dismutase (SOD), catalase (CAT) and glutathione peroxidase (GP×)] and nonenzymatic [(vitamin C, vitamin E, β-carotene and reduced glutathione (GSH)] in blood were measured at baseline and after 60 days of oil substitution.
Results: Patients with nifedipine alone or with respective oils had significantly lowered blood pressure. TC, LDL-C and TG decreased while HDL-C elevated in sesame and sunflower oil groups. Increases of HDL-C and TG were noted in groundnut oil group. TBARS levels reduced in all the groups whereas the reduction was remarkable in sesame oil group. Activities of SOD elevated in the 3 oil groups whereas GP× and CAT increased only in sesame oil group. Levels of vitamin C, vitamin E, β-carotene and GSH increased in sesame oil group whereas vitamin E and β-carotene were elevated only in sunflower and groundnut oil groups. GSH increased in drug control group also.
Conclusion: Among the 3 oils, sesame oil offers better protection over blood pressure, lipid profiles and lipid peroxidation and increases enzymatic and nonenzymatic antioxidants.

Keywords: Sesame oil; Sunflower oil; Groundnut oil; Blood pressure; Lipid profiles; Lipidperoxidation; Antioxidants

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1. Introduction

Hypertension is an important risk factor for cardiovascular ailments in India and worldwide. Elevated blood pressure is one of the most important and easily remediable factors for adverse cardiovascular outcomes, including stroke, myocardial infarction, renal failure and death [1]. The risk of hypertension increases progressively with increased oxidative stress [2,3]. Oxidative stress, the imbalance between pro-oxidants and antioxidants, has been implicated in the pathogenesis of hypertension [4].

Natural antioxidants and polyunsaturated fatty acids show protective function against hypertension [5]. The fatty acid composition of dietary fat is a key determinant of membrane fatty acid composition. A number of cellular functions including the activity of membrane-bound enzymes, transporters and hormone binding mechanisms may be dependent upon the type of fat in diet [6]. Earlier studies reported that polyunsaturated fatty acid rich diet reduces blood pressure and improves antioxidants' status in rats [7]. Several studies have been conducted on the biological activities of sesamin in sesame oil, and it was noted that sesamin inhibits lipid metabolism, such as desaturation in polyunsaturated fatty acid biosynthesis [8] and cholesterol absorption [9]. Vitamin E treatment was found to lower blood pressure and increase membrane fluidity in rats [10]. Supplementation of vitamin E reduces blood pressure in mild hypertensive patients and had caused a remarkable decrease in systolic and diastolic blood pressure [11]. Sesame, sunflower and groundnut oils contain varying amounts of polyunsaturated fatty acids and vitamin E and are largely consumed in South India. In this study, we have compared the effects of sesame, sunflower and groundnut oils on blood pressure, lipid profiles and redox status in hypertensive patients who were on treatment with nifedipine, an antihypertensive drug.

2. Materials and methods

2.1. Chemicals

Biochemicals were analytical grade and obtained from Sigma, Ranbaxy and Merck.

2.2. Subjects

The study group consisted of 530 middle aged, mild-to-moderate hypertensive patients who were on treatment with nifedipine (20–30 mg/day), a calcium channel blocker as an antihypertensive medication. The patients were selected from Rajah Muthiah Medical College and Hospital and Prof. Maniarasan Memorial Poly Clinic, Chidambaram, a taluk headquarters of Cuddalore District, Tamil Nadu, India. The criteria for inclusion in the patient group were established-hypertension, defined either by the need for chronic antihypertensive treatment, or, in untreated subjects, by a systolic blood pressure (SBP) >140 mm Hg or a diastolic blood pressure (DBP) >90 mm Hg or both. Subjects with clinical or biological signs of secondary hypertension, pregnant females, lactating mothers and chronic alcoholics were excluded. The Ethical Committee of Rajah Muthiah Medical College and Hospital, Annamalai University, Tamil Nadu, India approved the study and informed consent was obtained from each patient.

2.3. Study design

Hypertensive patients who were on medication with nifedipine were divided into 3 groups: sesame (n=356), sunflower (n=87) and groundnut (n=47) oil groups. Respective oils (Idhayam Gingelly oil, SVS groundnut and SVS sunflower oil-trade names) were supplied to the patients at 4–5 kg of oil per month for a 4-member family, approximately 30–35 g of oil per day per person. The patients were instructed to use respective oils as sole edible oil for cooking or otherwise, for 60 days while the control group (n=40) were treated only with nifedipine. The control group used sesame or sunflower or groundnut or palm oil at random. Blood pressure, lipid profiles, thiobarbituric acid reactive substances, activities of superoxide dismutase, catalase and glutathione peroxidase and levels of vitamin E, vitamin C, β-carotene and reduced glutathione were measured at baseline and after 60 days.

2.4. Blood pressure measurements

Blood pressure was measured by the same physician using standard mercury sphygmomanometer