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THE EFFECT OF DIFFERENT DEEP FRIED VEGETABLE OIL ON CARDIOVASCULAR SYSTEM IN RATS MODEL

Ramji Gupta*[1], Saurabh Kumar Vind[2], Surya Prakash Singh[3], Sokindra Kumar[4], Mukesh kumar[5]

[1]Asst. Prof. Department of Pharmacy R.V. Northland Institute U.P.

[2,3]Department of pharmacy R.V. Northland institute U.P.

[4]Principal, Department of Pharmacy R.V. Northland Institute U.P.

[5] Asst. Prof. Department of Pharmacy R.V. Northland Institute U.P.

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***Correspondence for Author**
Dr. Ramji Gupta
Asst. Prof. Department of Pharmacy R.V. Northland Institute U.P.

ABSTRACT

In vegetable oil (Olive oil, Soya oil, sunflower oil, Palm oil and Coconut oil) contains saturated, polyunsaturated fatty acids and triglyceride which is used in food, domestic and medicinal purpose. Recycling cooking oil for deep frying makes denatured of oil and more vulnerable to lipid peroxidation that generates oxidative compounds, linking to an increased risk of cardiovascular diseases. Ingestion of deep-frying oil has been reported to cause physiologic and histological changes in experimental animals tissue, increase the oxidative stress, and possibly lead to death. The purpose of this study was to investigate the effect of deep-frying oil on oxidative stress formation free radicals And blood pressure in spontaneously hypertensive. Long-term effect of recycled deep-frying oil cause increase plasma nitric oxide level, and vascular reactivity on blood pressure and aortic structure change in rats.

KEY WORD: - Deep frying, Lipid peroxidation, Vegetable oil, cardiovascular.

INTRODUCTION

The previous study proved that associations between high fat diets is more dangerous to chronic diseases such as obesity, heart disease and cancer are well known. The role of food preparation techniques in chronic disease has not been systematically investigated despite the fact that most of the foods that we consume today have been subjected to various method,

oxidation and polymerization. Convenience and snack foods have risen in density of popularity, particularly in deep-fat fried foods such as chicken, fish, and Chinese fried food. These foods absorb sufficient amounts of the oils used for deep-frying. When deep-fat frying Oil is usually heated to an absolute temperature at 180°C or above, it will get exposed to the moistured air and contamination, resulting in a extensive spectrum of chemical reactions collectively known as lipid oxidation. The chemical reactions in lipid oxidation have been previously described excellently in some articles [1, 2]. It is a complex phenomenon provoked by oxygen in the presence of initiators such as heat and free radicals[3]. Heated oil undergoes chemical reactions which include oxidation, hydrolysis, polymerisation and isomerisation. The reactions are deleterious to the stability of fatty acids and other biochemical parameters of the oil [4, 5]. Heated oil elevate the percentage of free fatty acid value (15-fold), such as peroxide value (8-fold), p-anisidine value (39-fold), total oxidation value (19-fold), thiobarbituric acid reactive substance (TBARS) value (8.5-fold), and trans fatty acid isomer value (2.5-fold) compared to the control [6]. Lipid oxidation can degrade the sensory property of the oil by darkening its colour, increasing its viscosity, causing foam and spoiling its flavour. So that repeated fried oils causes high risk of free radicals generation, oxidative stress and cardiovascular disease in rats.

Olive oil

(Olea europaea) as a source of monounsaturated fatty acids (MUFAs). It has been one of the proposed strategies for lowering the concentration of plasma cholesterol in humans, particularly when it replaces saturated fatty acids (SFAs) [7, 8]. It is well established that a positive correlation does exist between elevated plasma total cholesterol or low-density-lipoprotein (LDL) cholesterol concentrations and the prevalence of coronary heart disease, whereas an inverse correlation with high-density-lipoprotein cholesterol concentration [9, 10]. Indeed, diets supplemented with olive oil are reported to have beneficial effects on plasma lipids and lipoprotein profile in healthy subject [11,12] .Olive oil is contain about 72% oleic acid, a monounsaturated fatty acid [13]. Olive oil is unique with respect to the high oleic acid content because the majority of vegetables oils are composed primarily of polyunsaturated fatty acids, including the essential omega-6 fatty acid, linoleic acid. Compared to polyunsaturated fatty acids, oleic acid is monounsaturated, meaning it has one double bond, making it much less susceptible to oxidation and contributing to the antioxidant action, high stability, and long shelf life of olive oil [14]. The repeated heating of oil at high temperatures(≥180°C) results in the thermal oxidation of the oil, which causes the

configuration of the fatty acid to change from the cis isomer to the Trans isomer. This configuration change causes the PUFAs to acquire undesirable properties associated with SFAs, such as their correlation with increased serum cholesterol levels and higher low-density lipoprotein (LDL) cholesterol inparticular [15]. The repeated heating of cooking oil will result in oil that is more prone to lipid peroxidation [16]. Significantly increase blood pressure and NO in plasma level.

Soyabean Seed Oil

(*Glycine max*) is rich in polyunsaturated fatty acid. It was the previous study as it was one of the most widely used edible oil throughout world. Often, the practice of reusing the oil in food preparation to reduce inflicts toxic effects on health. The current study was undertaken to observe the possible biochemical and vascular mechanisms involved in the increase of blood pressure. Soybean oil of chemical composition performs well as a salad oil, but it is usually hydrogenated for use as a margarine stock or frying oil. Soybean oil's stability to oxidation also is limited by its content of linolenic acid. Recent decades have witnessed numerous attempts to manipulate the fatty acid composition of soybean oil to help it compete better in various uses. Soy fatty acid contains unsaturated Palmitic, Stearic, Saturated Oleic, Linoleic, Linolenic [17].

Cells are protected against ROS by a complex antioxidant system present within the cells, which includes superoxide dismutase (SOD), catalase and glutathione peroxidase (GPx) [18]. Within RBCs, protective mechanisms exist to detoxify and scavenge ROS, and protect endothelial cells against free radical damage [19]. There is an inverse relationship between reduced activities of antioxidants (SOD, GPx and vitamin E) and increased lipid peroxidation products in blood and cardiovascular disease [20]. The activities of the antioxidant enzymes, SOD, catalase and GPx have been found to be reduced both in whole blood and peripheral mononuclear cells in hypertensive subjects. In addition, concentrations of malondialdehyde (MDA) in whole blood and peripheral mononuclear cells have been shown to be increased in hypertensive subjects compared to control. MDA is an end product of lipid peroxidation, and therefore increased concentrations indicate an increase in ROS concentration and resulting oxidative damage [21]. After an acute ischemic stroke the activities of SOD and GPx were reduced and the concentration of MDA was increased in RBCs of animal subjects [22]. Deep heated soya oil multiple changes polymerization, ROS generation, oxidation, and free radicals generation cause high risk of cardiovascular chronic disease and aging.

Sunflower Seed Oil

(*Helianthus annuus* L.) contributes 30% in domestic edible oil. A previous study was planned to experimental and review the current status of its production of sunflower oil use in medicine and nutrition. It has medicinal values with regards to its benefits and side effects. Sunflower seeds contain 20-30% protein as well as iron, B vitamins, vitamin A, calcium, nitrogen and phosphorus. The constituents of the seeds are a volatile oil, carbonate of potash, tannin and excellent sources of the B vit. B complex including niacin and pantothenate. Sunflower oil is high in the essential tocopherol and low in saturated fatty acids. Two common types of sunflower oil are linoleic and high oleic. Linoleic oil has high levels of polyunsaturated fatty acids. It is also known for having a clean taste and low levels of *trans* fat. High oleic sunflower oils are classified as having monounsaturated levels of 80% and above. The iron-rich sunflower seeds are, by weight, 47% fat and 20-30 % protein [23].

Sunflower seeds oil [rich in oleic and linoleic acid] also demonstrated cardioprotective effect reported by reduction in occurrence of life-threatening arrhythmias in an animal study. Addition of 12% sunflower seed oil in rat food pellet for 4 weeks, decreased the incidence of reperfusion-induced ventricular fibrillation both after 6 min and 12 min of myocardial ischemia and the incidence of other arrhythmias was also decreased. The number of animals developing no arrhythmias during reperfusion was increased[24]. But deep fried of sunflower seed oil different chemical changes like saturated and poly unsaturated fatty acid are oxidation, polymerization and peroxidation of lipid. Cause free radicals generation, oxidative stress and high risk of cardiovascular disease.

Palm oil

(*Elaeis guineensis*) obtain from the fleshy mesocarp of the fruit. It is the second largest edible oil used worldwide[25]. Its SFA to USFA ratio is close to one and contains a considerable amount of antioxidants, namely, vitamin E and carotenes. Due to its composition, palm oil is naturally very stable and is commonly used as cooking oil, shortening, and bakery fat in various food products. Previous experiments have demonstrated the beneficial effects of palm oil in reducing arterial thrombosis [26, 27]. and BP [28]. However, palm oil is usually consumed in the oxidized state due to heat exposure during cooking. Heating the oil over a long period of time at high temperature ($\geq 180^{o}C$) produces oxygen derivatives, free radicals and hydroxylated products that impose a threat to body tissues, causing cancer, mutation, and atherosclerosis. Used in food preparation by road side vendors even in metro cities of many

countries. Repeated heating of the oil makes it more susceptible to lipid peroxidation [29, 30]. Often more use of this oil seems to reduce the cost of food preparation without concern for its toxic effects on health. Palm oil is free from cholesterol, rich in antioxidants and contains essential fatty acids, which play an important role in maintaining health. However, the heating process causes changes in palm oil composition. Considering the above facts, the present study was undertaken to determine the effects of heated palm oil on blood pressure and observe the histological findings in a rat model [31, 32]. Repeated deep fried oil usually changes in chemical composition due to oxidation, polymarisation and denatured oil. During biochemical changes like lipid profile, cholesterol, ketone body and NO level increase in plasma in blood.

Coconut oil

(*Cocos nucifera*) is a fruit which is abundant in the tropical and subtropical countries such as Philippines, Malaysia, Indonesia and India. Coconut products have been used either as a food or medication[33]. In coconut oil medium chain triacylglycerols are unique categories of lipids produced by the esterification of glycerol with medium chain fatty acids, which come from high lauric oils. Coconut and palm kernel oils are the only commercially important sources of medium chain fatty acids [34].

Virgin coconut oil (VCO) has become popular due to its beneficial effects. VCO has been shown to have anti-inflammatory, analgesic, and antipyretic properties[35]. VCO has been shown to decrease lipid levels in serum and tissue as well as LDL lipid peroxidation [36]. Consumption of VCO enhances antithrombotic effects related to inhibition of platelet coagulation and low cholesterol level [37]. VCO has been known to have higher antioxidant activity compared to refined coconut oil [38]. It has also been proven that VCO enhances antioxidant activity and inhibits lipid peroxidation in rats [39]. Therefore, it is of great interest for us to investigate whether VCO is able to prevent hypertension in male rats given repeatedly heated palm oil. Intake of VCO diet shows plasma NO level high in blood. It also increases plasma NO levels in rats fed with the 5HCO diet. This is thought to be due to the antioxidant component polyphenol, found in VCO which is responsible for increasing NO bioavailability. Antioxidant contents in VCO are possibly capable of providing protection effects by reducing oxidative stress and thus maintaining the NO bioavailability [40].

DISCUSSION

Hypertension is a worldwide health problem in developed most countries and one of the major independent risk factors for causing end-stage renal disease and cardiovascular complications. Although most epidemiologic studies have shown no clear relation between dietary fats and blood pressure, some have found an association between the intake of saturated fats and mean blood pressure [41, 42] and a negative relation to the intake of polyunsaturated fats. However, to our knowledge, no studies are reported in the literature regarding deep fried oil and blood pressure in animal models. The main finding of this study is that the risk of hypertension seems not to be dependent on the intake of deep fried oil but related to animal strain.

Oxidative stress is considered to involve enhanced vascular growth, vascular inflammation, and impaired endothelium dependency in hypertension [43]. During the oil-frying process of food preparation, various chemical reactions occur, such as oxidative and hydrolytic degradation and polymerization[44]. Present results for serum TBARS appeared highly influenced by the intake of deep fried oil. In fact, liver TBARS appeared to be increased in the rats fed deep fried oil. Several investigators have found that vitamin E decreases during the frying of oil [45, 46]. Moreover, the ingestion of oxidized frying oil increases the consumption of antioxidants in living tissues and leads to increased TBARS values and oxidative stress.

CONCLUSION

Deep-fat frying causes the hydrolysis, oxidation, and polymerization of the oil. Hydrolysis increases the amount of free fatty acids, mono- and diacylglycerols, and glycerols in oils. Oxidation occurs at a greater rate than hydrolysis during deep-fat frying. Oxidation produces hydroperoxides and then low molecular volatile compounds such as aldehydes, ketones, carboxylic acids, and short chain alkanes and alkenes. Dimers and polymers are also formed in oil by radical during deep-fat frying. Replenishment of fresh oil, frying conditions, quality of frying oil, food materials, fryer, antioxidants, and oxygen concentration affect the quality and flavor of oil during deep-fat frying. Intermittent frying with a lower turnover rate and higher temperature accelerates the oxidation and polymerization of oil during deep-fat frying. The frying quality of oil with high unsaturated fatty acids and free fatty acids is not as good as oil with low unsaturated fatty acids and free fatty acids. Addition of spinach and ginseng extract to the dough increases the oxidative stability of oil. Frying in a fryer with a small

surface-to-volume ratio is desirable to slow down the oxidation of frying oil. Tocopherols, BHA, BHT, PG, and TBHQ decrease oil oxidation, but they become less effective at frying temperature.

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