

Full Length Research Paper

Effects of rosemary on lipid profile in diabetic rats

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This study was to determine the mechanism underlying the hypoglycaemic activity of the aqueous extract perfusion of rosemary in normal and streptozotocin-induced diabetic rats. The sugar level and lipid profile were investigated in plasma of normal and streptozotocin-induced diabetic rats treated with rosemary for four weeks. Diabetic rats exhibited an increase in the levels of sugar, cholesterol, triglycerides and low density lipoprotein (LDL), and a decrease in the level of high density lipoprotein (HDL). The administration of rosemary showed a decrease of 20% in sugar level, 22% cholesterol, 24% triglycerides, 27% (LDL), and increase 18% in (HDL). The findings of this study indicate that the administration of rosemary shows better lipid profile as well as decrease in the sugar level in both normal and diabetic rats.

Key words: Diabetes, rosemary, lipid profile.

INTRODUCTION

Diabetes remedy that is gaining popularity today is herbal treatment, with a variety of plant- derived preparations being promoted as capable of controlling blood sugar levels, in fact, herbal treatment for diabetes is not known. Plants and plant extracts were used to combat the disease as early as 1550 B. C., with as many as 400 (prescribed) before the development earlier this century of effective medications to control diabetes (Linda et al., 2006).

Hyperlipidemia is an associated complication of diabetes mellitus (Miller et al., 2002). Chronic hyperglycaemia in diabetes leads to overproduction of free radicals and evidence is increasing that these contribute to the development of diabetic nephropathy (Sharma et al., 2006). Atherosclerosis and coronary heart disease are the major health problem in developed and modern societies (Braunwald, 1997; Breslow, 1997; Law, 1999). A number of epidemiological investigations have shown a clear association between dietary saturated fat

and atherosclerosis (Shekelle et al., 1981; Posner et al., 1991).

Moreover, many studies have now shown that elevated concentration of Low density lipoprotein (LDL) cholesterol in the blood are powerful risk factors for coronary heart disease (Law, 1999), whereas high concentrations of high density lipoprotein (HDL) cholesterol or a low LDL (or total) to HDL cholesterol ratio may protect against coronary heart disease (Sheten et al., 1991; Castelli et al., 1992).

The use of herbs as medicines has played an important role in nearly every culture on earth, including Asia, Africa, Europe and the Americas (Wargovich et al., 2001). Herbal medicine is based on the premise that plants contain natural substances that can promote health and alleviate illness. Several herbs can help to reduce blood sugar, high blood cholesterol concentrations, provide some protection against cancer and stimulate the immune system. Furthermore, a diet in which culinary herbs are used generously to flavor food provides a variety of active phytochemicals that promote health and protection against chronic diseases. Additionally, several commonly used herbs have been identified by the National Cancer Institute as possessing

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cancer-preventive properties. Rosemary (*Rosmarinus officinalis* Linn.), mint (Labiatae) family, is a common household plant grown in many parts of the world. It is commonly used as a spice and flavoring agent in food processing (Saito et al., 2004). Also, rosemary is used as an antispasmodic in renal colic and dysmenorrhoea, in relieving respiratory disorders and to stimulate growth of hair. Extract of rosemary relaxes smooth muscles of trachea and intestine, and choleric, hepatoprotective and antitumorigenic activity. However, rosemary and its constituents have a therapeutic potential in treatment or prevention of bronchial asthma, spamogenic disorders, diabetes, peptic ulcer, inflammatory diseases, hepatotoxicity, atherosclerosis, ischaemic heart diseases, cataract, cancer and poor sperm motility (Al-Sereiti et al., 1999; Masuda et al., 2002; Sotelo-Fleix et al., 2002; Osakabe et al., 2004).

The present research was designed to evaluate the effects of rosemary, for 4 weeks on blood lipid profile and blood sugar of rats. Blood lipid profile includes determination of the values of cholesterol, triglycerides, high density lipoprotein cholesterol (HDL), low density lipoprotein (LDL).

MATERIALS AND METHODS

Animals

Forty male albino rats weighing between 140 and 155 gm were procured from Department of Medical Technology, Zarka Private University, Jordan. The animals were housed in a well ventilated 12 h light and dark cycle. The animals were divided into 4 equal groups: group I, normal rats as control, group II streptozotocin treated animals (80 mg/kg intraperitoneally) to be diabetic rats, group III normal treated with rosemary, group IV diabetic rats treated with rosemary. The both groups, normal rats and diabetic rats that treated with streptozotocin were orally administered with rosemary for 4 weeks.

Rosemary extraction

50 gm of rosemary were soaked in 150 ml hot water (88°C) in water bath for 6 h. Then filtered by capron silic cloth 150 μ and the filtrate (which was 45 ml) were stored in dark bottles in refrigerator at (4°C). These procedures were repeated each week. Each group of rats were orally administrated of 0.5 ml rosemary extract

Blood sampling

Blood was collected after three days from streptozotocin treatment and this is considered zero time. Moreover, blood was taken at zero time and 4 weeks from eyes of all groups in heparinized tubes. Plasma was separated and kept in freezer till the time of assay.

Biochemical analysis

The following analyses were carried out: Glucose, Cholesterol, Triglycerides, Low and high density lipoprotein using kits from Symbio, France.

Statistical analysis

Collected data were tabulated and needed statistical analyses were done utilizing the computer data processing (SPSS, version 14). A probability value (P) of < 0.05 was considered to be statistically significant.

RESULTS

On Table 1, that depicts the level of plasma glucose, cholesterol, triglyceride, HDL and LDL in both control and experimental rats at zero time, showed that the diabetic rats marked an elevation in glucose concentration and lipid profile. Rosemary has no significant influence on serum glucose level and lipid profile of normal rats. While in the Table 2, shows mean value of the sugar and lipid profile after using rosemary for 4 weeks, their where reduction 20% in sugar level, 22% in cholesterol, 24% in triglyceride, 27% in LDL and increased 18% in HDL were significant at (P < 0.01) and (P < 0.05), respectively.

Since the rosemary is one of the dietary components that used every day in our food products, and it is well known as safe for human consumer, we recommended that it can be applied on human volunteers diabetic patients next step forward to this work.

DISCUSSION

The present result of oral administration of rosemary leaf extract caused significant declines in the blood levels of triglycerides, cholesterol, LDL, and increase HDL. Moreover, it seemed that rosemary leaf extract had a comparatively greater hypolipidemic potential. This may be an indication of progressive metabolic control of rosemary leaf extract on mechanisms involved in elimination of the lipids from the body. Hypolipidemic properties have been confirmed in many plant species and plant products in medicinal use (Kono et al., 1992; Naidu and Thippeswamy, 2002; Devi and Sharma, 2004). The most important constituents of rosemary are caffeic acid and its derivatives such as rosmarinic acid. These compounds have antioxidant effect (Al-Sereiti et al., 1999). A variety of phenolic compounds, in addition to flavonoids, are found in fruit, vegetables and many herbs. The phenolic compounds (such as caffeic, ellagic, and ferulic acids, sesamol, and vanillin) inhibit atherosclerosis (Decker, 1995). In addition to a well documented role in reverse cholesterol transport, HDL have recently been recognized to have several other important cardio protective properties including the ability to protect LDL from oxidative modification (Nofer et al., 2002). Also, Parthasarathy et al. (1990) suggested that HDL may play a protective role in atherogenesis by preventing the generation on an oxidatively modified LDL and the mechanism action of HDL may involve exchange of lipid peroxidation products between the lipoproteins. Several

Table 1. Depicts the level of plasma glucose and lipid profile at zero time without rosemary.

Normal rat		Diabetic rat	
Sugar	85.0 ± 6.1	Sugar	296.2 ± 5.2
cholesterol	92.3 ± 3.3	cholesterol	189.6 ± 4.1
triglyceride	88 ± 4.42	triglyceride	201.7 ± 9.2
LDL	60.2 ± 5.5	LDL	87.7 ± 8.5
HDL	51.3 ± 2.2	HDL	42.4 ± 3.4

Table 2. Depicts the level of plasma glucose and lipid profile at the end of 4 weeks with rosemary.

Normal rat with rosemary		Diabetic rat with rosemary	
Sugar	78.9 ± 6.3	Sugar	236.8 ± 9.6*
cholesterol	80.8 ± 4.5	cholesterol	147.4 ± 2.9*
triglyceride	71.7 ± 6.3	triglyceride	152.7 ± 9.1**
LDL	52.2 ± 4.2	LDL	63.6 ± 2.8**
HDL	62.15 ± 8.2	HDL	49.5 ± 4.3*

**Highly Significant at (P < 0.01). *Significant at (P < 0.05).

enzymes are present on HDL: paraoxonase (an enzyme normally resident on HDL), lecithin: Cholesterol acyl transferase, platelet activating factor acetylhydrolase, phospholipase D and protease. Apolipoproteins, such as polipoprotein AI, could also have enzymic activity (Mackness and Durrington, 1995). Mackness et al. (1993) suggested that a direct role for HDL in preventing atherosclerosis probably by an enzymic process which prevents the accumulation of lipid peroxides on LDL. They reported that paraoxonase is an example of an enzyme which might possibly be involved. Also, Bonnefont-Rousselot et al. (1999) reported that the oxidative hypothesis of atherosclerosis classically implies a central role for LDL oxidation.

However, the mechanism by which rosemary extract, exhibit hypolipidemic role is unknown. It is probably that rosemary leaf changed the rate of fatty acids oxidation in the liver and reduced the rate of triglycerides biosynthesis in rats.

Fuhrman et al. (2000) reported that polyphenols glabridin (derived from licorice), rosmarinic acid or carnosic acid (derived from rosemary), as well as garlic (which contains a mixture on natural antioxidants) inhibited LDL oxidation in a dose-dependent manner. Moreover, several studies showed that plant extracts lowered LDL oxidation (Ramirez-Tortosa et al., 1999; Doi et al., 2000; Naidu and Thippeswamy, 2002). However, the present data demonstrated that consumption of rosemary lead to reduction in the risk of hyperlipidemic symptoms and heart diseases. It can be concluded from presented results that rosemary, expressed hypolipidemic role. Moreover, additional investigation will be needed to purify the bioactive constituents in the extract and use the purified constituents for bioassay-

directed experiments either in hyperlipidemic or non-hyperlipidemic organisms.

Suzuki et al. (2002) suggested that intake of vegetables and fruits rich in carotenoids might be protective factor against hyperglycemia. Flavonoids are functional constituents of many fruits and vegetables. Some flavonoids have antidibetics properties because they improve altered glucose and oxidative metabolisms of diabetic states.

Platel and Srinivasan (1997) reported that vegetables are among numerous plant adjuncts tried for the treatment of diabetes mellitus, green leafy have shown the beneficial hypoglycemic influence in both experimental animals and humans.

On the other hand all treated groups with rosemary induced a higher mean value of HDL as compared to the control group.

In this respect Linda et al. (2006) reported that the antioxidant properties of rosemary are of particular interest in view of the impact of oxidative modification of low-density lipoprotein cholesterol in the development of atherosclerosis. Herbs and spices have an important role in dietary flavonoids intake. Chamomile, onions, rosemary, sage and thyme have high flavonoids contents, but there is little evidence apart from epidemiological studies to support a direct cardiovascular health benefit from these herbs and spices.

Olmedilla et al. (2001) reported that basal diets containing goadaid reduced the levels of bad cholesterol (LDL) concentration, TC and TG. She observed also good cholesterol (HDL) level was raised in diet with goadaid. Exposure to high fruit and vegetable diet increases antioxidant concentrations in blood and body tissues and potentially protects against oxidative damage

to cells and tissues.

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