



The Effect of Hydro-Alcoholic Extract of Broccoli Leaves on Sugar and Lipids in Serum of Diabetic Rats

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ABSTRACT

Nowadays, no-drug treatments (medicinal plants) are novel therapeutic approaches in the treatment of diabetes. Broccoli is a plant in the cabbage family, whose large flower head is used as a vegetable. The mass of flower heads is surrounded by leaves. Broccoli was derived from cultivated leafy cole crops in the Northern Mediterranean in about the 6th century. This study aimed at assessing the effect of Broccoli leaves extract on the blood glucose and lipid profile in diabetic rats. Thirty male adult rats were randomly selected and divided into three groups as nondiabetic control; diabetic control; diabetic rats treated with hydroalcoholic extract of Broccoli leaves. In diabetic groups, alloxan monohydrate (100 mg/kg) was injected intraperitoneally to develop diabetes. Then the Test group received intraperitoneal injection of hydro-alcoholic extract of Broccoli leaves (100 mg/kg). At last, glucose, cholesterol, triglyceride, HDL, VLDL, LDL and insulin contents of the rats' serum sample were determined. Diabetic rats treated with extract showed a significant decrease in blood glucose level ($p < 0.05$). Furthermore, compared diabetic group, in the extract-treated rats, there was a significant decrease in serum contents of total cholesterol (TC), LDL, VLDL and TG, but a significant increase in insulin level and HDL ($p < 0.05$). These results show that the hydroalcoholic extract of Broccoli leaves may be effective in the treatment of diabetes. This effect can be due to the presence of flavonoides and their antioxidant features.

Keywords: RP-HPLC, UV detection, Lamivudine, Tenofovir, validation, ICH guideline

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1. INTRODUCTION

Broccoli was first introduced to the United States by Italian immigrants but did not become widely known there until the 1920s. It is usually boiled or steamed, but may be eaten raw and has become popular as a raw vegetable. The leaves also be eaten. The mature leaves get up to 2 feet long with hefty ribs and stems. They look intimidating, but they cook down deliciously just like any other green (1, 2). Diabetes is the most common endocrine disease being characterized with increased blood sugar (hyperglycemia) and disorders in metabolizing carbohydrates, lipids, and proteins (3, 4, 5). In diabetes mellitus, chronic hyperglycaemia produces multiple

biochemical sequelae, and diabetes-induced oxidative stress could play a role in the symptoms and progression of the disease (6). Use of medicinal plants in medicine is increasing because of their widespread use and for their curing various diseases. In this study was undertaken to evaluate the antidiabetic activity of hydro-alcoholic extract of Broccoli leaves on glucose serum, lipid profile and releasing insulin from pancreas of healthy animals with diabetes caused by alloxan monohydrate.

2. METHODS AND MATERIALS

Plant material: Broccoli leaves were collected and dried in shadow according to drying process in 2012, at

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department of biology, Science and Research Branch, Islamic Azad University, Shahrekord, Iran. Then, the dried leaves were grinded to a uniform powder and weighed. The most important and essential part of extraction of plant material is the selection of a proper organic solvent which depends on the part and constituents of the plant. In this study, a mixture of ethanol and water in the ratio of 7:3 was prepared. Then, 500 g of the Broccoli leaves powder were extracted by maceration method for three days. The extracted material was filtered and the filtrated material was concentrated under vacuum evaporator until dryness.

Animals: In present study, we used 30 male rats from Wistar race in weight range of 200 and 230 g. Animals were randomly divided to three groups of ten rats (principles for laboratory animal used European Community guidelines (EEC Directive of 1986; 86/609/EEC)):

Control group: healthy rats which received physiologic serum equal to the injected extract volume. This was done to equalize the shock resulted from injection;

Diabetic control group: diabetic rats which were affected by single intraperitoneal injecting of 100 mg/kg monohydrate alloxan, and were treated with physiologic serum;

Diabetic rats treated with Broccoli leaves extract: the rats which were affected as well as the second group. And 100 mg/kg hydro-alcoholic extract of Broccoli leaves injection was performed for 10 successive days after assuring that rates were affected by diabetes.

Two days after the last injection, the bleeding was performed from all groups and the resulted serum was used to determine blood glucose, cholesterol, triglyceride, and lipoproteins (LDL and HDL) with enzyme kits (from Zist-Shimi, Iran).

During the study, storage, injection of various materials, bleeding, and perishing animals were performed according to standard methods of working with laboratorial animals. In statistical survey of findings, the one-way ANOVA test was applied to compare average of each variable in test groups and then Tukey test was performed. Statistical analysis of findings was done with SPSS software and $p < 0.05$ was treated meaningful.

3. RESULTS

Results of biochemical tests of glucose, Insulin, cholesterol, triglyceride, HDL, LDL, and VLDL is shown in Table 1.

4. DISCUSSION

Research has shown that broccoli has all sorts of wonderful properties that can help you live a longer and healthier life. It is full of antioxidants, is packed with vitamins and minerals, and is full of fiber; at the same time, it has very few calories. All those things are just plain

healthy. It's a shame we don't see broccoli leaves sold in the store. Broccoli leaves are richer in beta-carotene than the florets, and contain other healthy phytonutrients that aren't found in the stems and florets. One of the big problems that diabetes can cause is damage to the blood vessels; that is why many diabetics have problems with circulation to their feet and lower legs and hands, and it is also why people with diabetes tend to be at higher risk for heart attack and stroke. But broccoli - the blood sugar wonder - is here to help with those issues. In present study, we examine the effect of hydroalcoholic extract of Broccoli leaves on biochemical parameters of blood. Results from this study show that in treated group, blood glucose, triglyceride, cholesterol, LDL, HDL, and VLDL level had a meaningful decrease ($p < 0.05$) compared to the diabetic control group and blood insulin and HDL level had a meaningful increase ($p < 0.05$) compared to the diabetic control group. According to several studies, specific toxicity of alloxan for Beta-cells of pancreas is due to quick absorption of alloxan by pancreatic Bata-cells and free radicals production by alloxan. Free radicals can cause reversible or irreversible damages to cellular compound of creatures (such as proteins, lipids, carbohydrates, nucleic acids, etc.) and thereby affect cellular activities such as function of membrane, metabolism, and gene expression. Therefore, some cells would lose their structure and activity. According researches, oxidative damage of free radicals is main cause of damage to cells and tissues in some diseases such as arthroscleroses, cancer, mellitus diabetes, etc (7). Antioxidants are compounds that protect cellular membrane and various components of creatures against oxidants. Mechanism of action of these compounds is gathering free radicals, transferring electron to these electrons, and inactivation of them (8, 9).

Experimental groups (groups 10 rats)			
Index	Control	Diabetic Control	Treated by hydro-alcoholic extract of Broccoli leaves
Glucose (mg/dL)	125±14	768±107.4	275±35
Triglyceride (mg/dL)	107±13	227±13	131±28.3
Cholesterol (mg/dL)	94.7±11	111.9±9.5	105.2±9.8
LDL (mg/dL)	24±5.9	40±11	24±8.8
HDL (mg/dL)	50±6.8	27±5.8	55±11.9
VLDL (mg/dL)	22±1	46±2.8	27±4.3
Insulin (:u/mL)	12.55±1.45	4.86±1	12.18±1.6

Table 1: Effect of hydro-alcoholic extract of Broccoli leaves on level of serum glucose, insulin, cholesterol, triglyceride, and lipoproteins in studied group of rats (mean±standard deviation)

Mean glucose difference of treated group with diabetic control and control groups: Meaningful ($p < 0.05$); Mean triglyceride difference of treated group with diabetic control group: Meaningful ($p < 0.05$); Mean LDL difference of treated group with diabetic control group: Meaningful ($p < 0.05$); Mean HDL difference of treated group with diabetic control group: Meaningful ($p < 0.05$); Mean VLDL difference of

treated group with diabetic control group: Meaningful ($p < 0.05$); Mean insulin

difference of treated group with diabetic control group: Meaningful ($p < 0.05$)

Broccoli leaves extract to increase anti-oxidative defense and to control damages resulted from oxidative stresses and has presence of flavonoids as an essential factor in extract structure and suppose it probable that Proanthocyanidin compounds existing in Broccoli leaves extract are among effective factors in incidence of anti-oxidative properties. Broccoli is beneficial for diabetics. It will, however, not be able to reverse the disease, but can help in maintaining a healthy cardiovascular system by the action of its antioxidants and phytochemicals. Broccoli is rich in dietary fiber which can lower levels of LDL, cholesterol. This lowering of cholesterol helps protect the arteries and prevents the onset of heart disease. High fiber foods such as broccoli also help with weight loss, an important factor in controlling diabetes as it decreases insulin resistance. The less resistant cells are to insulin, the more effective it is in keeping blood sugar levels under check (10). EunYoung Ko investigated hypoglycemic effects of Broccoli in hyperglycemic rats for prevention of type-2 diabetes in 2010 and pointed this matter (11). According to results from this research, consumption of antioxidants existing in Broccoli leaves contributes to decrease damages to cells and, specially, accelerates restoration of pancreatic cells and subsequently increases insulin and decreases blood glucose. In rats affected by diabetes with alloxan, increased blood glucose level can indirectly increase cholesterol, triglyceride, LDL, VLDL level of serum and decrease HDL level (12, 13).

Similarly, this accounts for to some extent undesirable changes serum lipids level in rats affected by diabetes in present study. According to the results, disorders in lipids metabolism resulted from diabetes would be obviated by controlling blood glucose with Broccoli leaves extract. Therefore, this would also decrease HDL in addition to decreasing blood glucose, triglyceride, LDL, and VLDL. This is in turn due to high level of anti-oxidative substances existing in extract of Broccoli leaves, which can induce desirable metabolic changes associated to hepatic enzymes as to improve undesirable changes blood glucose and lipid levels. According to this study, it can be

concluded that one of mechanisms of hydro-alcoholic extract of Broccoli leaves effect on diabetes in rats is restoration of Islets of Langerhans followed by increased insulin level.

6. CONCLUSION

This study implies that treating with hydro-alcoholic extract of Broccoli leaves leaf has blood glucose and lipid decreasing effects in rats affected with diabetes by monohydrate alloxan.

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