The Effect of Hydro-Alcoholic Extract of Strawberry Leaf on Sugar and Lipids in Serum of Diabetic Rats

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Summary

As rich sources of natural antioxidants, Herbs are used to cure many diseases in traditional medicine. The researches have shown that some herbal extracts have anti-diabetic effect, so they can be used to lower blood sugar in people with diabetes. For elucidating the effects of strawberry on diabete, 24 male adult rats were randomly selected and divided into three groups as nondiabetic control; diabetic control and diabetic rats treated with hydroalcoholic extract of strawberry leaf. In diabetic groups, alloxan monohydrate (120 mg/kg) was injected intraperitoneally to develop diabetes. Then the Test group received intraperitoneal injection of hydro-alcoholic extract of strawberry leaf (100 mg/kg). At last, glucose, cholesterol, triglyceride, HDL, and LDL contents of the rats' serum sample were determined. The findings show that using hydro-alcoholic extract of strawberry leaf decreased meaningfully glucose, cholesterol and triglyceride contents of diabetic rats' blood serum ($p<0.01$) and increased HDL content ($p>0.05$), but it didn't effected noticeably on LDL content. Considering these findings, it is found that strawberry leaf can be effective in decreasing blood sugar and fat in diabetic people due to presence of flavonoids and their antioxidant properties.

Key words: Strawberry, Blood Sugar and Lipid, Diabetes.

Introduction

Diabetes is the most common endocrine disease being characterized with increased blood sugar (hyperglycemia) and disorders in metabolizing carbohydrates, lipids, and proteins. Diabetes is caused by either disorder in insulin secretion or insulin function; and during the disease process, all body systems and organs are involved. Due to unpleasant effects of sugar-lowering chemical drugs and their high cost, it seems necessary to find compounds which can lower blood sugar with minimum by-effects. Due to crescent increase of diabetic population and various effects of diabetes, it is necessary to pay attention to this disease.(1,2) Since using herbs has been common and different diseases have been cured one or more herbs or herbal extracts of yore and due to the miraculous role of these herbs in curing diseases, their usage is ever-increasing. Many researches in recent years have shown that some herbal compounds have an anti-diabetic effect so can be used in diabetic people to lower blood sugar. As an example, hypoglycemic effect of alcoholic extract of dandelion leaf has been proved by many researches.(3) Therefore, the present research is aimed to reach a compound that can affect on diabetes with minimum unpleasant by-effects and that can be used in the diabetics to lower blood sugar. Strawberry is a shrubby plant with big leaves and thin,

creeper stalks, which spreads and takes root on ground. Since a long time ago, all parts of this plant have had a medical application and have been used in various forms.

In present study, we have examined the role of alcoholic extract of strawberry leaf on glucose serum and lipid profile of healthy animals and animals with diabetes caused by alloxan monohydrate.

Materials and methods

Plant material

Following identification and for extraction, strawberry leaves were dried in shade and then were powdered. 100 g of resulted powder was placed into a one-liter erlen and 96% ethylic alcohol was added such that covered the powder surface. The solution was filtered after 24 hours. In the next phase, 75% alcohol was added to dross and the resulted solution was filtered after 24 hours. The filtered solutions were mixed and then were concentrated with a distilling machine in vacuum at 50°C and 70rpm into one third of initial volume. In order to separate protein, lipid, and chlorophyll, the concentrated solution were decanted with 50ml chloroform for three times. The resulted solution from the last phase was dried in autoclave in <50°C and sterile conditions. In this manner, the extract dried powder was prepared after a few days and dried powder was stored at 4°C.(4)

Animal Samples:

Animals were randomly divided into three groups of 8 members: the control group (injection of physiological serum into the peritoneum), diabetic group (injection of 120 mg/kg alloxan monohydrate into the peritoneum for three alternative days), and diabetic group receiving the extract (being affected by diabetes like the second group and then injecting 100 mg/kg strawberry leaf hydro-alcoholic extract into peritoneum for five alternative days).

48 hours 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.

Results

Comparison of serum glucose concentration:

The average serum glucose content in both control and diabetic groups were 122.4±20 mg/dl and 525.7±55 mg/dl respectively, and in extract treated diabetic group it was 342.2±43 mg/dl. The mean difference among the three groups was meaningful ($p<0.01$)(Table 1).

Comparison of serum cholesterol concentration:

The average serum cholesterol content in both control and diabetic groups were 71±12 mg/dl and 111.9±7.5 mg/dl respectively, and in extract-treated diabetic group it was 75.4±8 mg/dl. The mean difference of cholesterol in extract-treated diabetic group is meaningful comparing to diabetic group ($p<0.01$) but it has no meaningful difference comparing to control group (Table.1).

Comparison of serum triglyceride concentration:

The average triglyceride content in both control and diabetic groups were 83.5±15 mg/dl and 182.5±24 mg/dl respectively, and in extract-treated diabetic group it was 92.5±16 mg/dl. The mean difference of triglyceride in extract-treated diabetic group is meaningful comparing to diabetic group ($p<0.01$), but it has no meaningful difference comparing to control group (Table.1).

Comparison of serum HDL concentration:

The average serum HDL content in both control and diabetic groups were 38.4±3.5 mg/dl and 22.5±5.2 mg/dl respectively, and in extract-treated diabetic group it was 39.1±3.4 mg/dl. The mean difference of HDL in extract-treated diabetic group is meaningful comparing to diabetic group ($p<0.05$) but it has no meaningful difference comparing to control group (Table.1).

Comparison of serum LDL concentration:

The average serum LDL content in both control and diabetic groups were 18.4±4.2 mg/dl and 33.7±3.5 mg/dl respectively, and in extract-treated diabetic group it was 25.6±4.7 mg/dl. The mean difference of LDL in extract-treated diabetic group was not meaningful comparing to diabetic group but it was meaningful comparing to control group ($p<0.05$) (Table.1).

Table.1: measured values of blood sugar, cholesterol, triglyceride, and lipoproteins (mg/dl) in studied groups (mean ± standard deviation)

variable / group*	Non-diabetic control (healthy)	Diabetic control	Receiving the extract
Glucose	122.4±20	525.7±55	342.2±43 **
Cholesterol	71±12	111.9±7.5	75.4±8 **
Triglyceride	83.5±15	182.5±24	92.5±16 **
HDL	38.4±3.5	22.5±5.2	39.1±3.4 ***
LDL	18.4±4.2	33.7±3.5	25.6±4.7

*the number of rats in each group is 8. ** $p<0.01$ comparing to control group for associated variable; *** $p<0.05$ comparing to diabetic control group for associated variable

Discussion

In present study, increased serum glucose which was done with destroying islets of Langerhans β-cells and with monohydrate alloxan, is similar to Byung-Hyun Park findings.(5) One of hydro-alcoholic extract effects of strawberry leaf is controlling α-amylase and α-glycosidase and by this way it lowers the blood sugar content. This activity is associated to existing antioxidant compounds (flavonoids, ellagic *acid*, and antocianine) in mentioned extract.(6)

By increasing blood sugar content in diabetic rats following injecting alloxan, triglyceride content also increased that is similar to Ton BK and Zhang XF findings and shows insulin contribution in adjusting lipids metabolism.

In addition to its effect on metabolism and hypoglycemic effects, extract of strawberry leaf effects on lipid metabolism, recovery of body antioxidant system, and function of capillaries and typically controls blood pressure and blood sugar.(7)

Considerable decrease in triglyceride content by hydro-alcoholic extract of strawberry leaf can be explained as follow: by improved glycemic control and decreased blood glucose by the extract, glucose consumption instead of lipids to produce energy would increase and A-coenzyme acetyl from pyruvic *acid* enters into krebs cycle rather than synthetic phase of triglycerides and then cause final metabolizing of glucose.

With rats being affected with diabetes, LDL content would increase and HDL content would decrease that confirms the results from Abou-Seif, Durrington, Winocour, Bhartnagar, Ishla, MA, and Yussef AA.(8,9)

Due to the fact that serum HDL concentration has a negative relation with triglyceride, and considering this fact that strawberry leaf could decrease triglyceride content. So, one can expect that HDL will increase by decreased triglyceride. In the meanwhile, by improved metabolic path of glucose, proteins' metabolism would adopt anabolic paths instead of inclining toward catabolic effects; thereby, synthesis of such proteins as APO-A1, which consists about 70% of HDL structure, will increase that in turn would result in increased HDL concentration in rats.(10,11)

Therefore, this study implies that treating with hydro-alcoholic extract of strawberry leaf has blood glucose and lipid decreasing effects in rats affected with diabetes by monohydrate alloxan.

References

1. Jodeph F.smith. Antidiabetic drugs , Medical library 2003؛ 5 : 5-6.

2. Barnett, Philip; Bronestein (2003): Principles of Internal Medicine – Mellitus Diabetes; Arjomand, Tehran, Iran [Translated to Persian].

3. Hussain Z,Waheed A , Qureshi RA , Burdi dk verspohl EJ , Kan N , et al , The effect of medical plant's on Islamabad and murree rejoin of Pakistan on insulin secretion from INS-1 cell's Phyother Res 2004; 18(1) : 73-77.

4.Namasivayam, N. Hypolipidemic effect of Cuminum cyminum L .on alloxan – induceddiabetic rats. Pharmacologial research 2002; 46 (3): 251 – 255.

5. Byung-Hyun Park,Jin-Woo Park.The protective effect of Amomum xanthides extracts against alloxan-induced diabetic rats through the suppression of NF B activation. Experimental and Medicine 2001;33: 64-68.

6. Hannum, S. M. Potential impact of strawberries on human health: a review of the science. Crit. ReV. Food Sci. Nutr. 2004, 44, 1–17.

7. Broadhurst, C. L. Nutrition and non-insulin dependent diabetes from an anthropological perspective. Alt. Med. ReV. 1997, 2, 378–399.

8. Winocour PH, Durrington PN, Bhatnagar D, Ishola M, Arrol S, Mackness M, Abnormalities of VLDL, IDL and LDL characterize insulin dependent diabetes mellitus. Arterosclerosis and Thrombosis 1992;12:920-928.

9. Abou-Seif MA,Yussef AA,. Evaluation of some biochemical changes in diabetic patients. Clin Chem Acta 2004; 346(2):161-170.

10. Naghsh, Noushin: Examining Serum lipids and lipoproteins Relation with Intra- and Extracellular Magnesium in Diabetized Rats; M.A. Thesis, Science College of Isfahan University, Isfahan, Iran [in Persian].

11. Georg P, Ludvic B, Lipids and diabetes. J clin Basic CXardio l2000; 3:159-162.