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Some biochemical parameters of diabetic rats treated with aqueous extract of Trigonella foenum graecum (fenugreek) seeds

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ABSTRACT :

Trigonella foenum graecum (fenugreek) seeds has been suggested to have potential anti diabetic effects. Twenty four white female rats were used to study the effect of oral administration of Trigonella seed extract with water tap on some biochemical parameters of alloxan induced diabetic rats. These animals were divided into four groups. The first group was a negative group treated with water tap, while the other groups (2-4) were treated with 150mg/kg alloxane for induced a diabetic. the second group was a positive group (diabetic group) treated with water tap. The third group treated with 0.04 gm/ml aqueous extract of fenugreek seeds for 28 days. The fourth group treated with 0.08 gm/ml aqueous extract of fenugreek seeds for 28 days. The result revealed a significant decrease in the level of blood glucose of the animals groups treated with 0.04 gm/ml and 0.08 gm/ml aqueous extract of fenugreek seeds compared with positive control group. Also, the results indicated non significant decreased in cholesterol, SGOT, SGPT third and fourth groups compared with normal and a diabetic groups.

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INTRODUCTION:

Diabetes mellitus (DM) is in the top 5 of the most significant diseases un the developed world, and is gaining in significance there and elsewhere. Present number of diabetics worldwide is 171 million and this is likely to increase to 340 million or more by the year 2030 (1,2). It is a hetrogenous group of metabolic disorders characterized physiologically by deficiency in insulin or insulin activity and clinically by hyperglycemic or impair glucose tolerance and other manifestable disorders(3). In resent years, numerous traditional medicinal plants were tested for their anti diabetic potential in the experiment animals (1). *Trigonella foenum-graecum* L., Legominosae (Fenugreek) is one of the oldest medicinal plants, is of Mediterranean origin and cultivated worldwide. It is commonly known as fenugreek, is extensively used in many preparations of Ayurveda and also against anti ulcer action (4) and hypocholesterolaemic effects (5,6). Fenugreek (*Trigonella*

foenum-graecum) is commonly used as a condiment and seasoning in food preparations, is assumed to possess nutritive and restorative properties (7) and has been used in folk medicine for centuries for a wide range of diseases including diabetes, fever and abnormal colic as a poultice for abscesses, boils, and carbuncles (8). Aqueous extract of seeds of fenugreek have been shown to possess hypoglycemic activity and are nontoxic(9). They are also helpful in lowering fever as it is equal to quinine. The seeds' soothing effect makes them of value in treating gastritis and gastric ulcers. They are used to induce childbirth and to increase breast-milk production. Fenugreek is also thought to be anti diabetic and to lower blood cholesterol levels(10) Fenugreek seed contains 45-60% carbohydrates, mainly mucilaginous fiber (galactomannans); 20-30% proteins high in lysine and tryptophan; 5-10% fixed oils (lipids); pyridine-type alkaloids, mainlytrigonelline (0.2-0.36%), choline (0.5%), gentianine and carpaine; the flavonoids apigenin, luteolin, orientin, quercetin, vitexin and isovitexin; free amino acids, such as 4-hydroxyisoleucine (0.09%); arginine, histidine and lysine; calcium and iron; saponins (0.6-1.7%); glycosides yielding steroidal sapogenins on hydrolysis (diosgenin, yamogenin, tigogenin, neotigogenin); cholesterol and sitosterol; vitamins A, B1,C and nicotinic acid; coumarin compounds and 0.015% volatile oils (nalkanes and sesquiterpenes)(11). The plant is a legume, rich in soluble dietary fiber and protein.(2, 5, 12). Fenugreek seeds and its extract have exhibited hypoglycemic and hypocholesterolemic activity in animal and human models(6, 7, 8, 13, 14).Its hypoglycemic activity is ascribed to the presence of soluble dietary fiber (7), saponin fraction, and 4-hydroxyisoleucine, a free amino acid (8). The hypoglycemic activity of fenugreek seed is also due to glucose-dependent insulin secretion from pancreatic beta cells and trigonella seed that can slow the rate of glucose absorption (5). Also *Trigonella foenum graecum* in addition to hypoglycemic effect have anti chlesterolemic action (12, 15). (16) have reported in 10 subjects with hypercholesterolemia that administration of defatted fenugreek lowered cholesterol . The present study aimed to investigate the effect of Trigonella foenum-graecum seeds on some biochemical parameters of diabetic female rats.

MATERIALS AND METHOD:

Experimental animals:

Female rats weighing 150-170 gm with 8 weeks of old were used. All animals were obtained from animal house of biology department / college of education / university of Thi-Qar / Iraq. They were housed in groups of four in a temperature controlled room (20±2 °C)with a12 h light/12 h dark cycle (light son at 07.00 a.m.). The animals were divided into the bellow:

1. The first group (negative control group) treated orally with water tap for 28 days.
2. The second group (positive control group, diabetic group) treated orally with water tap for 28 days**.**
3. The third group , diabetic group treated with 0.04 gm/ml aqueous extract of fenugreek seeds for 28 days**.**
4. The fourth group , diabetic group treated with 0.08 gm/ml aqueous extract of fenugreek seeds for 28 days**.**

Preparation of diabetic rats:

Rats were induced diabetes by the administration of single intraperitoneal injection of alloxan monohydrate (150 mg/kg) (4), after fasting animals for (18 h).

Tested plants:

The tested plants were *Trigonella foenum graecum* (fenugreek) seeds, which purchased from local market in Al-Nassiriyai city / Thi-Qar province / Iraq. 10 gm, 20 gm of plant seeds were added to (250 ml) of water & boiled for(10 min), after cooling & filtering by using funnel & filter paper, clear supernatants were taken with concentrate about (0.04 gm / ml, & 0.08 gm / ml) respectively.At the end of experiment , animals were sacrificed after short exposure to ether , blood from heart , and serum was separated for chemical analysis which included blood glucose, cholesterol, SGOT and SGPT. These biochemical parameters were performed by using of kits. Statistical analysis of the results was performed by SPSS test, data are presented as Mean ± Stander Error.

RESULTS:

The present study indicated that there is a significant elevation ($p<0.01$) in blood glucose of alloxan-induced rats(255.76 ±7.35) compared with the normal rats (70.033 ± 5.015) (table 1). These raised levels of blood glucose in diabetic rats were declined sharply after oral administration of aqueous extract of *Trigonella foenum graecum* (fenugreek) seeds. When comparisons were made between diabetic and drug treated animals, blood glucose levels were found to be declined sharply from 255.76 ±7.35 mg/dL on 28 days to the(62.346 ± 5.226) with 0.04 gm/ml & 77.155 ± 11.238 with 0.08 gm/ml) ($p<0.01$).The cholesterol is elevated non significantly in alloxan-induced rats(1.266 ± 0.145) compared to the normal rats (1.066 ± 0.088), oral administration of aqueous extract of Trigonella foenum graecum (fenugreek) seeds showed decrease serum cholesterol level in group 1 and group 2 (0.966 ± 0.064, & 1.15 ± 0.064) respectively compared with the diabetic control group(1.266 ± 0.145) (table 2). Also, this study indicated a non significant increased in serum glutamate oxaloacetate transaminase (SGOT) level (31.66 ± 1.66) and serum glutamate pyruvate transaminase (SGPT) (37.0 ±1.0) in alloxan-induced diabetic rats compared with normal rats (28.33 ± 3.33 , 36.66 ± 1.66) respectively. The oral dose of the herbal extract showed a non significant alternation the SGOT level and SGPT in alloxan-induced diabetic rats(30 ± 0.0 ، 34.33 ± 3.48) and (33.75 ± 1.25 , 36 ± 2)in groups 2 and 3 respectively compared with the diabetic rats (Tables 3). The result indicated that the effect of fenugreek seed extract tends to bring the values to near those of the non diabetic control rats.

DISCUSSION

The use of traditional medicine and medicinal plants in most developing countries, as a normative basis for the maintenance of good health was widely observed(17). Over 50% of currently available drugs are derivatives of plant(18). Various reports revealed that fenugreek possess plethora of benefits under various experimental conditions(19). The fenugreek seed possess antidiabetic effect (16). The present study indicated that the extract of fenugreek seeds caused a significant decreased of blood glucose level in diabetic rats . In agreement with the present results, the hypoglycemic effect of fenugreek seeds has been experimentally proved in induced diabetic rats, dogs, mice and healthy volunteers and type I and II diabetic patients (3, 16, 17).There are two possible explanations for this finding, first may exert its effect by preventing the death of beta cells and or second, it may permit recovery of partially destroyed beta cells (10). (20) reported that the hypoglycemic action of the extract of herbal plants in diabetic rats may be possible through the insulinomimictic action or by other mechanism such as stimulation of glucose uptake by peripheral tissue, inhibition of endogenous glucose production of activation of glcuoneogenesis in liver and muscle. A marked increase in serum cholesterol level was observed in untreated diabetic rats, whereas the administration of fenugreek decreased the serum cholesterol in diabetic rats.(18 ,21, 22) reported that the administration of fenugreek seed extract lowered the serum cholesterol level in diabetic rats. (23) reported that fenugreek reduced serum cholesterol levels of type 1 diabetic patients. Fenugreek was reported to lower serum cholesterol levels in rats and normal and diabetic dogs**(**24, 25**).**The study on the extent of degradation of the saponin and/or diosgenin and other steroid saponins in the alimentary tract of alloxan diabetic dogs suggested that steroid saponin and sapogenin might have a role in lowering cholesterol (26). (27) showed diabetic increased the levels of SGOT and SGPT in liver. It seems that the diabetic complications in the liver like hepatocyte destruction are like to be due to alternations in enzyme levels. It may be concluded that fenugreek seed extract possess anti diabetic activities and the seeds extract may be used as an anti diabetic agent. The plant should be considered as an excellent candidate for future studies on diabetes mellitus. In addition, further comprehensive pharmacologic investigations, including experimental chronic studies should be carried out.

Table (1): Effect of aqueous extract of Fenugreek seed on the blood glucose level in normal, alloxan diabetic & alloxan diabetic treated rats for 28 days.

Parameter	Normal	Control	Group 1	Group 2
Blood glucose	70.033± 5.015[b]	255.76 ± 7.53[a]	62.346 ± 5.226 [b]	77.155 ± 11.238 [b]

Values given as mean of 6 rats ± SE.
Means with the same letter are not significantly different at p<0.01
The different letters refers to a significant differences at p<0.01

Table (2): Effect of aqueous extract of Fenugreek seed on the cholesterol level in normal, alloxan diabetic & alloxan diabetic treated rats for 28 days.

Parameter	Normal	Control	Group 1	Group 2
Cholesterol	1.066 ± 0.088 [a]	1.266 ± 0.145 [a]	0.966 ± 0.066 [a]	1.15 ± 0.064 [a]

Values given as mean of 6 rats ± SE.
Means with the same letter are not significantly different at p<0.01
The different letters refers to a significant differences at p<0.01

Table (3): Effect of aqueous extract of Fenugreek seed on the serum glutamate oxaloacetate transaminase (SGOT) and serum glutamate pyruvate transaminase (SGPT) in normal, alloxan diabetic & alloxan diabetic treated rats for 28 days.

Parameter	Normal	Control	Group 1	Group 2
SGOT	28.33 ± 3.33 [a]	31.66 ± 1.66 [a]	30 ± 0.0 [a]	33.75 ± 1.25 [a]
SGPT	36.66 ± 1.66 [a]	37.0 ±1.0 [a]	34.33 ± 3.48 [a]	36 ± 2 [a]

Values given as mean of 6 rats ± SE.
Means with the same letter are not significantly different at p<0.01
The different letters refers to a significant differences at p<0.01

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بعض المعايير الحيوية للجرذان المحدثة السكر والمعالجة بالمستخلص المائي لبذور نبات الحلبة

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الخلاصة:

تمتلك بذور نبات الحلبة تأثير فعال في معالجة السكر. في هذه الدراسة تم استخدام(24) جرذان ابيض من الإناث لدراسة تأثير بذور نبات الحلبة على بعض المعايير الحيوية للجرذان المحدثة السكر باستخدام الالوكسان باستخدام طريقة الإعطاء الفموي(مع ماء الشرب).هذه الحيوانات تم تقسيمها إلى أربع مجاميع.ألمجموعه الأولى هي ألمجموعه السلبية المعالجة فقط بالماء(ماء الشرب)، أما المجاميع (٢-٤) فقد عولجت بالالوكسان ١٥٠ ملغم/كغم لاستحداث السكر ، ألمجموعه الثانية هي ألمجموعه الايجابية (مجموعة السكر فقط) والتي عالجناها فقط بالماء (ماء الشرب). أما ألمجموعه الثالثة فقد عولجت ب ٠,٠٤ غم/مللتر من المستخلص المائي لبذور نبات الحلبة لمدة ٢٨ يوم، أما ألمجموعه الرابعة فقد عولجت ب٠,٠٨غم/مللتر من المستخلص المائي لبذور نبات الحلبة لمدة ٢٨ يوم.

أظهرت النتائج انخفاض معنوي في مستوى سكر الدم للحيوانات المعالجة ب ٠,٠٤ غم/مللتر و٠,٠٨ غم/مللتر من المستخلص المائي لبذور نبات الحلبة مقارنة مع ألمجموعه الايجابية المعالجة بالالوكسان فقط، كذلك النتائج أظهرت انخفاض غير معنوي في مستوى الكولسترول، مستوى الكلوتاميت اوكزاليت ترانس امينيز للمصل ، ومستوى الكلوتاميتت بايروفيت ترانس امينيز للمصل للمجاميع ألثالثه والرابعة مقارنة بالمجاميع الأولى (الطبيعة)، والمجموعة ألثانيه ألمعامله بالالوكسان.

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