

THE EFFECT OF CUMIN ON INDUCED DIABETES IN RATS

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ABSTRACT

The present study was conducted to evaluate the effect of Cumin on diabetes mellitus induced by alloxan in rats. Male Wister rats were used, and randomly divided into five groups (6-8 rats for each group): The first group: was administered distilled water and served as normal control, the second group: induced diabetes by single subcutaneous injection of alloxan 100 mg/kg.body weight and served as diabetic control, the 3,4,5 groups was administered 50,100,200 gm/kg of rat's forage respectively for four weeks, then diabetes are induced in this groups by same route as above. Cumin treatment in all doses lead to significant decrease glucose levels, and triglyceride and significant decrease in cholesterol level in dose 100, 200 gm/kg of forage and no change occur in total protein level. These results indicate that cumin have a role in delaying of diabetes through the effects of cumin in decrease some biochemical parameters.

INTRODUCTION

Diabetes mellitus is a metabolic disorder characterized by resistance to the action of insulin, or insufficient secretion, or both (1). The major clinical manifestation of the diabetes state is hyperglycemia, however, insulin deficiency and/or insulin resistance also are associated with disturbance in lipid and protein metabolism (2). WHO indicates that diabetes mellitus is one of the major killers of humans in our time (3). Management of diabetes without any side effect is still a challenge to the medical system; this had led to

an increasing demand for natural products with antidiabetic activity and fewer side effects (4).

Spices form an important class of food adjuncts in human diet, besides enhancing the taste and flavor of foods; spices exhibit a wide range of physiological and pharmacological properties (5).

Cumin (*Cuminum Cyminum*), a small, annual herbaceous plant of the Umbelliferae family. Cumin is a popular spice all over the world, especially in Latin America, North Africa, and all over Asia. It has known to the Egyptians 5,000 years ago and formed an important medicine of ancient Egypt (6, 7).

Fruit are the medical part of cumin, cumin has numerous uses such as drug and spicy for about a thousand years ago (8). Cumin is used as a stimulant, antispasmodic, carminative particularly in veterinary practice and antimicrobial agent. Cumin is used widely in traditional medicine to treat flatulence, digestive disorders and diarrhea and in the treatment of wounds (9), Fungitoxic (10), cumin also help ease and increase secretion of milk in lactating women (11), also uses for cold and fever (12).Cumin contain volatile oils (13).Also cumin contain vitamins like vitamin C, and A, also contain amino acids, proteins, minerals, starch tannin and fibers (14), In addition to flavones (15), and Glucosides (16).

Cumin are used for treatment diabetes, recent researches record the activity of extraction of cumin to decrease the level of glucose in normal and in alloxan-induced diabetic rats (17) and decrease lipid profile (18, 19).

In addition to decrease levels of uric acid and total proteins (20) and decrease level of creatinin (21).

The present study was conducted to evaluate the effect of Cumin on diabetes mellitus induced by alloxan in rats.

MATERIAL AND METHODS

Animals: Male albino rats, 3-4 months old and 167-218 gm body weight were housed in hanging cages in the animal house of the college of veterinary medicine-University of Mosul, and maintained under laboratory controlled of temperature (22 ± 2) and light (14 hour light and 10 hour dark), pelleted food and tap water were given.

Induction of diabetes: Rats were fasted for 48 hour before inducing diabetes with alloxan (Molekala-England). Diabetes was induced by a single subcutaneous injection of alloxan in a dose of 100 mg/kg of body weight (22). Rats were allowed to drink 5% glucose solution overnight to prevent hypoglycemia. Alloxan treated animals were monitored by periodic testing for glucosuria using Lilly Test Tap and ketonuria using chemstrip MH 5000/k (Boehrinher, Mannheim, Germany) (23).

Plant: Cumin was purchased from the local market in Mosul, and it's identify was confirmed biochemically in the Research Center of the college of Science, university of Mosul. The cumin was powdered before uses.

Experimental design: Animals randomly were divided into five groups, each consisting of 6-8 rats. Group 1: Served as negative control group ; Group 2: Induced Diabetes and served as positive control group ; Group 3: normal rats received cumin 50gm /kg of forage for four weeks ; Group 4: normal rats received cumin 200 gm /kg of forage for four weeks ; Group 5: normal rats received cumin 100 gm /kg of forage for four weeks.

After four weeks diabetes are induced in groups: 3,4,5, and after 24 hours of injection, blood samples were collected for biochemical parameters.

Samples collection: Blood samples were collected from the orbital plexus of vein into clean dry centrifuge tubes allowed to clot, serum was separated after centrifugation at 1500 rpm for 15 minutes (24), serum biochemical parameters were measured using colorimetric assay kits (Bicon, Diagnostic GmbH, Burbach, Germany).

Statistical analysis: All data analyzed by one way analysis of variance, the specific group differences were determined using Duncan multiple range test; the accepted level of significance was $P < 0.05$ (25).

RESULT

Induced diabetes by alloxan lead after four weeks to a significant increase in levels of glucose (Table 1), with decreased significantly level of total proteins (Table 4). And no significant effect on both cholesterol and triglyceride levels (Table 2, 3).

Table 1,3: is indicating that administration of cumin in all doses lead to significant decrease levels of both serum glucose and serum triglyceride when compare with diabetic groups.

As shown in table (2) there are significant decrease in serum cholesterol level in groups received cumin in dose 100, 200 gm/ kg of forage, with no significant effect in 50 gm / kg of forage.

Our result shown that administration of cumin in all doses lead to decrease serum total protein levels when compared with the diabetic group, but there are a significant changes in groups which treated with cumin doses 50, 100 gm/ kg of forage (table 4).

Table (1): Effect of cumin on serum glucose level in rats.

Groups	Serum glucose level (mg/dl)			
	Time zero	Time after treatment (hour)		
		2 hour	4 hour	24 hour
Control	A 91.64± 6.38	A 94.94± 4.01	A 96.34± 3.16	A 74.79± 2.63
Alloxan	A 85.27 ± 4.54	E 426.15± 3.78	E 464.99 ± 2.13	D 364.59 ± 5.61
Cumin 50 gm/kg of forage	A 83.84 ± 3.10	C 281.25 ± 7.11	C 288.22± 6.87	A 103.94± 6.45
Cumin 100 gm/kg of forage	A 90.63 ± 2.85	B 203.57 ± 9.62	BC 243.68 ± 5.99	A 49.06 ± 4.76
Cumin 200 gm/kg of forage	A 99.03 ± 6.3	A 73.76 ± 6.11	B 209.16 ± 4.13	B 196.31 ± 6.6

No. of rats (6-8) in each group

Data is the mean ± SEM

Different letters indicate significant differences between groups horizontally and vertically at P < 0.05

Table (2): Effect of cumin on serum cholesterol level in rats.

Groups	Serum cholesterol level (mg/dl)	
	Time zero	Time after 24 hour
Control	C 183.75 ± 7.59	C 155.99 ± 6.74
Cumin 50 gm/kg of forage	C 183.01 ± 9.57	C 171.27 ± 8.82
Cumin 100 gm/kg of forage	C 173.36 ± 4.77	A 44.09 ± 6.79
Cumin 200 gm/kg of forage	C 153.22 ± 6.11	B 87.54 ± 3.11

No. of rats (6-8) in each group

Data is the mean \pm SEM

Different letters indicate significant differences between groups horizontally and vertically at $P < 0.05$

Table (3): Effect of cumin on serum Triglyceride level in rats.

Groups	Serum Triglyceride (mg/dl)	
	Time zero	Time after 24 hour
Control	CD 57.85 \pm 4.97	D 62.88 \pm 5.83
Cumin 50 gm/kg of forage	BCD 54.07 \pm 6.08	BC 48.41 \pm 3.98
Cumin 100 gm/kg of forage	CD 59.05 \pm 5.62	A 27.93 \pm 5.78
Cumin 200 gm/kg of forage	BC 44.17 \pm 3.91	BC 42.92 \pm 2.29

No. of rats (6-8) in each group

Data is the mean \pm SEM

Different letters indicate significant differences between groups horizontally and vertically at $P < 0.05$

Table (4): Effect of cumin on serum Total protein level in rats.

Groups	Serum Total protein level (g/dl)	
	Time Zero	Time After 24 hour
Control	BC 5.09 \pm 0.73	A 3.87 \pm 0.36
Cumin 50 gm/kg of forage	CD 5.37 \pm 0.35	A 4.05 \pm 0.52
Cumin 100 gm/kg of forage	D 5.90 \pm 1.03	A 4.11 \pm 0.6
Cumin 200 gm/kg of forage	AB 4.36 \pm 0.52	A 4.05 \pm 0.14

No. of rats (6-8) in each group

Data is the mean \pm SEM

Different letters indicate significant differences between groups horizontally and vertically at $P < 0.05$

DISCUSSION

The result from present study showed that injection of alloxan leads to significant increase of glucose level, and this result are agree with (4, 26, 27) in rats. This may due to destruction of β -cells of pancreas by alloxan which lead to stop production of insulin (28). Also causes diminishes of inters of glucose to cells leads to increase its level in blood (29). Alloxan reacts with two SH- groups in the sugar binding side of glucokinase resulting in the formation of the disulfide bond and inactivation of the enzyme (30).

From the result of present study showed that treatment with cumin 50,100,200 gm/kg of forage lead to decrease serum glucose level when compare with diabetic control group, this results are agree with result of (31) in rabbit, and in diabetic rats (17, 18, 21). The effect of cumin may due to its ability to inhibit α -glucosidase (32), this enzyme are responsible about degrades disaccharide like sucrose, and polysaccharide like starch to monosaccharide (33), (34) refer that treatment with polyphenolic compound extracted from black cumin in rats leads to decrease serum glucose level as a result to the effect of α -glucosidase.

The hypoglycemic effect of cumin may due to presence of flavones (15), which found that flavones have an effect to inhibit α -glucosidase, and Aldose reductase (35), also flavones cause decrease absorption of glucose from intestine through decrease glucose transport processes that depend on calcium (36), similar effect were found in flavones of soybean (37).

Other possible mechanism to decrease of serum glucose level due to cumin administration may due presence of Cuminaldehyde (32), this substance have an ability to inhibit α -glucosidase, and Aldose reductase, and these both enzyme are work to prevent rises of insulin level in the body (38).

Treatment with cumin resulted decrease serum blood cholesterol, this results were agree with (18,19,39) in normal and diabetic rats induced by alloxan, and don't agree with results of (40) in rats.

The cholesterol reduction effect of cumin may due to it's activity as antioxidant, which shown that there are an increase in activity of Superoxide dimutase & catalase (41), also presence of flavones in cumin which work as antioxidant via inhibit oxidation of

lipoproteins, and increase activity of low density lipoproteins (42), similar results were shown from (43) in mice when treated with soybean seeds contains flavones.

The lowering of cholesterol levels may be due to sterol that presence in cumin (44), Sterol acts to decrease estrification of cholesterol in gastric cells and reverses the unestrified cholesterol again to intestine (45). Also sterols increase cholesterol acyltransferase Acyl CoA, and increase production of bile acids and oxidation of lipoproteins and increase activity of lipase & liver lipase Lipoprotein lead to decrease cholesterol level (46), similar lowering effect of cholesterol were shown in treatment with extract of *Moringooleiferm Lam* (47), and *Terminalia bellerica Roxb* (48) because they contain sterol.

Significant decrease of blood triglyceride levels were observed in rats treated with cumin, this result agree with (13) in alloxan-induced diabetic rats, and result of (49) in type 2 diabetic patient, this lowering effect may due to presence of unsaturated fatty acids in cumin (44), (50) refer that treatment with unsaturated fatty acids present in fish oil leads to decrease serum triglyceride level in normal and alloxan-induced diabetic rats.

The role of fatty acids may due to its effect in facilitate metabolism processes of very low density lipoprotein, and chylomicrone (51).

From our result we observed that alloxan lead to decrease total protein level, and this due to decrease synthesis, and increase catabolism protein (52).

When rats treated with cumin in all doses lead to non-significant increase in serum total protein level when compared with control, but when compared with zero time there are a significant increase in total protein level when rats treated with cumin in doses 50,100 gm/kg of forage.

This effect may due to that cumin have characteristics similar to insulin (39) where play a prominent role in synthesis of proteins through increase translation of mRNA (51).

Our study indicate that cumin have a role in delaying of diabetes through decrease some biochemical parameters.

تأثير نبات الكمون على استحداث داء السكر بالجرذان

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الخلاصة

أجري هذا البحث لمعرفة تأثير نبات الكمون Cumin على قابلية الإصابة بداء السكر المستحدث بالالوكسان. تم استخدام ذكور جرذان مختبرية من نوع Wister وقسمت عشوائياً الى خمسة مجاميع (كل مجموعة 6-8 جرذان): تامجموعة الأولى: أعطيت الماء المقطر و عدت مجموعة سيطرة موجبة، المجموعة الثانية: حققت تحت الجلد بمادة الالوكسان Alloxan وبجرعة 100 ملغم/كغم من وزن الجسم لأستحداث داء السكر تجريبياً و عدت مجموعة سيطرة سالبة، المجاميع: 3،4،5 أعطيت نبات الكمون بتركيز 50،100،200 غم/كغم علف على الترتيب ولمدة أربعة أسابيع، بعدها تم أستحداث داء السكر بالالوكسان. أظهرت النتائج أن إعطاء نبات الكمون وبكافة التراكييز قد أدى الى أنخفاض معنوي في مستوى الكلوكوز والكليسيريدات الثلاثية، والى أنخفاض معنوي في مستوى الكولسترول عند المعاملة بالتراكيز 100،200 غم/كغم علف، ولم يكن لنبات الكمون أي تأثير على مستوى البروتين الكلي. نستنتج من الدراسة الحالية ألى أن نبات الكمون يمتلك دوراً في تأخير الاصابة بداء السكر من خلال التأثير المخفض لبعض الأختبارات الكيموحيوية.

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