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Potential Effect of Nutmeg and Bay Leaves on experimental rats with Alloxan –Induced Diabetic Rats

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Abstract

The present study was designed to determine the effect of nutmeg and bay leaf in Alloxan diabetic rats. Forty-eight male albino rats weighing 140 – 150 gm were randomly divided into two groups of six animals each. Group I (G1) was the negative control group, and Group II was injected with a single intra-cage dose of Alloxan: (150 mg/kg body weight) to induce diabetes. Group II was then randomly divided into seven sub-groups—G2, the Positive control group; G3, fed 2.5% nutmeg; G4, fed 5% nutmeg; G5, fed 2.5% bay leaf; and G6, G7 fed 2.5,5% mixture of nutmeg and bay leaf respectively, for four weeks. The results of the obtained data indicated that the tested natural herbs ($P \leq 0.05$) decreased blood glucose, serum VLDL and increased HDL compared to the positive control group. The tested natural herbs also improved liver and kidney functions. The results conclude that nutmeg and bay leaf contains several compounds that can improve hyperglycemic rats' adverse effects and inhibition.

Key words: Rats, spices, blood sugar, Biochemical analysis

1. Introduction

Diabetes mellitus is a clinical syndrome due to relative or absolute deficiency of insulin or resistance to the action of insulin at the cellular level; as a result, hyperglycemia and glycosuria occurs. Diabetes is one of the most common chronic diseases in the world, impacting over 100 million individuals. Hyperglycemia, improper lipid and protein metabolism, and distinct long-term consequences affecting the retina, kidneys, and nervous system characterize the two major kinds of diabetes mellitus [(1)].

Mace is the dried lacy reddish covering on the seed of *Myristica fragrans*, whereas nutmeg is the actual seed of M. fragrans. Nutmeg is used as a stomachic, carminative, aphrodisiac, and anti-diarrheal agent in traditional medicine [(2)].

The significant antioxidant activity of nutmeg (Myristica fragrans, Houtt.) has also been attributed to the phytochemicals occurring naturally in the tree [(3)].

The hypoglycemic effects of nutmeg extract in diabetic rats were described [(4)].The fact that extract-treated groups had lower glucose levels could be attributable to an increase in the number of -cells producing insulin in pancreatic islets. These rats' pancreatic cells appeared to be healed, allowing them to manufacture insulin, as seen by lower blood glucose levels at the end of the therapy period.

Nutmeg dramatically reduced blood glucose levels and boosted serum insulin levels in diabetic rats, according (5).In diabetic rats, nutmeg extract decreased oxidative stress and increased antioxidant activity in pancreatic tissue.

The active component of bay leaves is most likely a polyphenol, as polyvinyl pyrrolidone, which binds aromatic hydroxyl groups, removed more than 80% of the in vitro insulin potentiating effect. Polyphenols present in bay leaves have been shown to help with insulin sensitivity, glucose absorption, and antioxidant status [(6)].

According [(7)].the bioactive components found in bay leaf compounds, such as polyphenols, have been shown to affect insulin sensitivity, glucose uptake, antioxidant status, inflammatory response, and glucose emptying. Therefor this research aimed to evaluate the chemical composition of bay leaves and nutmeg and to know its effects on diabetic rats.

Materials And Methods

Materials

Source of bay leaves and nutmeg:

Nutmeg (*Myristica fragrans*, L) seeds and bay (*Laurus nobilis*, L) leaves were obtained from local herbalist in October 2021, at Shibin El-Kom City, Menoufia Governorate, Egypt.

Experimental animals:

A total of (48) male Albino rats weight ranges between (140-150 g) were obtained from Vaccine and Immunity Organization, Ministry of Health, Helwan Farm, Cairo, Egypt.

Alloxan:

Alloxan which is chemically known as 5, 5-dihydroxyl pyrimidine-2, 4, 6-trione is an organic compound, a urea derivative, a carcinogen and cytotoxic glucose analog. The

compound has the molecular formulae, $C_4H_2N_2O_4$ and a relative molecular mass of 142.06, were obtained from Al-Gomhoria.

Casein, cellulose, choline chloride, and DL- Methionine:

Casein, cellulose, choline chloride powder, and DL methionine powder, were obtained from Morgan Co. Cairo, Egypt.

The chemicals and kits:

Chemical kits used in this study (TC, TG, HDL-c, ALT, AST,
ALP, urea, creatinine, albumin) were obtained from Al-Gomhoria Company for Trading Drug, Chemical and Medical Instruments, Cairo, Egypt.

Methods:

Preparation of nutmeg and bay:

Netumeg seeds and bay leaves were obtained from local herbalist, then grinded to obtain the powder form according to [8].

The induction of experimental diabetes:

Diabetes was inducing in normal healthy male albino rats by intra-peritoneal of Alloxan 150 mg/kg body weight, according to the method described by [9].

One week after the injection of Alloxan, fasting blood samples were obtained to estimate fasting serum glucose 150 mg/dl rats which were considered diabetes [10].

Experimental design:

Fort-eight male albino rats weight ranges between (140-150 gm) during the experiment period.

Rats were acclimatized to being fed and water ad libitum for 1 week [11], and rats were divided into 8 groups each group that consists of six rats as follows:

Group (1: Rats fed on basal diet as a negative control.

Group (2): Diabetic rats fed on basal diet as a positive control.

Group (3): Diabetic rats fed on nutmeg seeds powder at does 2.5% of the weight of the diet.

Group (4): Diabetic rats fed on nutmeg seeds powder at does by 5% of the weight of the diet.

Group (5) : Diabetic rats fed on bay leaves power by 2.5% of the weight of the diet.

Group (6) : Diabetic rats fed on by bay leaves power 5% of the weight of the diet.

Group (7): Diabetic rats fed on mixture 1:1 of nutmeg seeds and bay leaves by 2.5% of the weight of the diet.

Group (8): Diabetic rats fed on mixture 1:1 of nutmeg seeds and bay leaves 5% of the weight of the diet.

Feed intake and body weight were determined weekly. At the end of the experimental period (28), each rat weight separately then, rats are slaughtered and collect blood

samples. Blood samples were centrifuged at (4000 rpm) for ten minutes to separate blood serum, then kept in deep freezer till using. Extracting the liver following tests was conducted for pathophysiological examinations.

Blood sampling:

After fasting for 12 hours, blood samples in initial times were obtained from retro orbital vein, while it obtained from hepatic portal vein at the end of each experiment. Blood samples were taken. The first parts of blood samples were collected into a dry clean centrifuge glass tubes and left to clot in water bath (37°C) for 28 minutes, then centrifuged for 10 minutes at 4000 rpm to separate the serum, which were carefully aspirated and transferred into clean cuvette tube and stored frozen at -20°C till analysis according to the method described by **(12)**.

Biochemical analysis:

Lipids profile:

Serum total cholesterol (TC), was determined according to the colorimetric method described by **(13) .**serum triglycerides **(**TG**)** was determined by enzymatic method using kits according to the **(14)**.HDL-c was determined according to the method described by **(15).**VLDL-c was calculated in mg/dl according to **(16)** using the following formula:

VLDL-c (mg/dl) = Triglycerides / 5. LDL-c was calculated in mg/dl according to (17) as follows:

LDL-c (mg/dl) = Total cholesterol – HDL-c – VLDL-c.

Liver functions:

Determination of serum alanine amino transferase (ALT), serum aspartate amino transferase (AST), serum alkaline phosphatase (ALP) was carried out according to the method of (18, 19&20), respectively.

Kidney functions:

Serum urea, serum creatinine and uric acid was determined by enzymatic method according to (21, 22&23).

Determination of blood glucose level:

Serum glucose was measured using the modified kinetic method according to (24) by using kit supplied by spin react. Spain.

Statistical analysis:

The data were analyzed using a completely randomized factorial design when a significant main effect was detected; the means were separated with the Student-Newman-Keuls Test. Differences between treatments of ($P \leq 0.05$) were considered significant using Costat Program. Biological results were analyzed by One Way ANOVA **(25)**.

Results and Discussion

Data presented in Table (1) showed effect of nutmeg, bay leaves and their mixtures on glucose level of experimental rats. The obtained results showed that glucose level of positive control recorded the higher value when compared with negative control with significant difference. The mean values were 258. 0 and 99. 25 %, respectively. From diabetic rat groups, it is clear to notice that the highest glucose level recorded for 2.5 mg/kg nutmeg while the lowest glucose level recorded for 5 % mixture with significant difference (P≤0.05). The mean values were 150 and 132. 50 respectively .These results are agreement with the obtained by **(26)** bay leaves Bay leaves have been shown to improve insulin function .The objective of this study was to determine if bay leaves may be important in the prevention and/or alleviation of type 2 diabetes. Forty people with type 2 diabetes were divided into 4 groups and given capsules containing 1, 2 or 3 g of ground bay leaves per day for 30 days or a placebo followed by a 10 day washout period. All three levels of bay leaves reduced serum glucose with significant decreases ranging from 21 to 26% after 30 d. This study demonstrates that consumption of bay leaves, 1 to 3 g/d for 30 days, decreases risk factors for diabetes and cardiovascular diseases and suggests that bay leaves may be beneficial for people with type 2 diabetes.

Table (1): Effect of nutmeg, bay leaves and their mixtures on glucose level of experimental rats.

Treatment groups	Glucose level (mg/dl)
G1 Control group (-)	99.25^{f}± 0.10
G2 Control group (+)	258.0^{a}± 0.14
G3 Rats + nutmeg (2.5%)	150.0^{b}± 0.13
G4 Rats + nutmeg (5%)	148.9^{b}±0.11
G5 Rats + bay leaves (2.5%)	144.50^{c}±0.12
G6 Rats + bay leaves (5%)	141.25^{d}±0.13
G7 Rats with mixture (2.5%)	140.00^{d}±0.12
G8 Rats with mixture (5%)	132.50^{e}±0.14

Each value is represented as mean ± standard deviation (n = 3). Mean under the same column subscribed with different letters are significantly different (P≤0.05).

Data presented in Table (2) showed the Effect of nutmeg, bay leaves and their mixtures on liver functions of diabetic rats. The obtained results showed that AST (U/L) of positive control recorded the higher value when compared with negative control with significant difference. The mean values were 75.00 and 20. 80 %, respectively. From diabetic rat groups, it is clear to notice that the highest AST (U/L) recorded for 2.5 mg/kg nutumeg, while the lowest AST (U/L) recorded for 5 % mixture with significant difference (P≤0.05). The mean values were 52. 55 and 27. 65 %, respectively.

Data presented in Table (2) showed Effect of nutmeg, bay leaves and their mixtures on liver functions of diabetic rats. The obtained results showed ALT (U/L) % of positive control recorded the higher value when compared with negative control with significant difference. The mean values were 90. 65 and 31. 65 %, respectively. From diabetic rat groups, it is clear to notice that the highest ALT (U/L) % recorded for 2.5 mg/kg nutmeg, while the lowest ALT (U/L) % recorded for 5 % mixture with significant difference (P≤0.05). The mean values were 73. 70 and 57. 15 %, respectively. These results are in agreement with the obtain by [27] 21 different spices were fed to rats with liver damage caused .nutmeg showed the most potent hepatoprotective activity. Bioassay-guided isolation of the active compound from nutmeg was carried out in mice by a single oral administration of the respective fractions. Myristicin, one of the major essential oils of nutmeg, was found to possess extraordinarily potent hepatoprotective activity. Myristicin markedly suppressed LPS/D-GalN-induced enhancement of serum TNF-α concentrations and hepatic DNA fragmentation in mice. These findings suggest that the hepatoprotective activity of myristicin might be, at least in part, due to the inhibition of TNF-α release from macrophages. However, further studies are needed to elucidate the hepatoprotective mechanism(s) of myristicin.

Table (2): Effect of nutmeg, bay leaves and their mixtures on liver functions of experimental rats.

Treatment parameter	Liver functions		
	AST (U/L)	ALT (U/L)	ALP (U/L)
G1 Control group (-)	20.80^{g}±0.12	31.65^{f}±0.13	33.00^{e}±0.11
G2Control group (+)	75.00^{a}±0.16	90.50^{a}±0.12	73.00^{a}±0.13
G3 Rats + nutmeg (2.5%)	52.55^{b}±0.10	73.70^{b}±0.14	56.70^{b}±0.10
G4 Rats + nutmeg (5%)	46.65^{c}±0.13	66.50^{c}±0.10	49.85^{c}±0.12
G5 Rats + bay leaves (2.5%)	42.70^{d}±0.12	62.60^{d}±0.13	41.55^{d}±0.14
G6 Rats + bay leaves (5%)	32.80^{e}±0.11	58.90^{e}±0.11	40.80^{d}±0.13
G7 Rats with mixture (2.5%)	46.55^{c}±0.14	62.70^{d}±0.13	49.60^{c}±0.11
G8 Rats with mixture (5%)	27.65^{f}±0.15	57.15^{e}±0.14	39.55^{d}±0.15

Each value is represented as mean ± standard deviation (n = 3). Mean under the same column subscribed with different letters are significantly different (P≤0.05).

Data presented in Table (2) showed the effect of nutmeg, bay leaves and leaves and their mixtures on liver functions of diabetic rats. The obtained results showed that ALP (U/L) % of positive control recorded the higher value when compared with negative control with significant difference. The mean values were 73 .00 and 33 .00 %, respectively. From diabetic rat groups, it is clear to notice that the highest ALP (U/L) % recorded for 2.5 mg/kg nutmeg, while the lowest ALP (U/L) % recorded for 5 % mixture with significant difference (P≤0.05). The mean values were 56. 70 and39. 55 %, respectively.

These results are in agreement with the obtained by [28]. Nutmeg treated mice showed statistically significant alteration in the biochemical indicators of liver function including significant elevation in AST, ALT, ALP and TSB in a dose dependent manner. The nutmeg essential oil carries a marked specific potential toxicity to the liver parenchyma, this is very important to be.

Data presented in Table (3) showed effect of nutmeg, bay leaves and their mixtures on total cholesterol and triglycerides of diabetic rats. The obtained results showed that total cholesterol (mg/dl) % of positive control recorded the higher value when compared with negative control with significant difference. The mean values were 150. 00 and 70. 65 %, respectively. From diabetic rat groups, it is clear to notice that the highest total cholesterol (mg/dl) % recorded for 2.5 mg/kg nutmeg, while the lowest total cholesterol (mg/dl) % recorded for 5 % mixture with significant difference ($P \leq 0.05$). The mean values were 124. 5 and 78. 5 %, respectively. These results are in agree with the obtained by [26] bay leaves decreased total cholesterol 20%to 24%after 30 day (1-3) gm.

Data presented in Table (3) showed effect of nutmeg, bay leaves and their mixtures on total cholesterol and triglycerides of diabetic rats. The obtained results showed as for triglycerides (mg/dl) % of positive control recorded the higher value when compared with negative control with significant difference. The mean values were 132. 5 and 65. 10 %, respectively. From diabetic rat groups, it is clear to notice that the highest triglycerides (mg/dl) % recorded for 2.5 mg/kg nutmeg, while the lowest triglycerides (mg/dl) % recorded for 5 % mixture with significant difference ($P \leq 0.05$). The mean values were 118. 25and 73. 50 %, respectively. These results are in agreement with the obtained by [26] bay leaves decrease triglycerides 34% to25% (1-3) g for 30 days

Table (3): Effect of nutmeg, bay leaves and their mixtures on total cholesterol and triglycerides of experimental rats.

Treatment/Parameter	Total cholesterol (mg/dl)	Triglycerides (mg/dl)
G1 Control group (-)	$70.65^{h} \pm 0.14$	$65.10^{g} \pm 0.15$
G2Control group (+)	$150.00^{a} \pm 0.13$	$132.5^{a} \pm 0.13$
G3 Rats + nutmeg (2.5%)	$124.50^{b} \pm 0.14$	$118.25^{b} \pm 0.11$
G4 Rats + nutmeg (5%)	$104.50^{c} \pm 0.15$	$94.75^{c} \pm 0.14$
G5 Rats + bay leaves (2.5%)	$93.50^{e} \pm 0.12$	$87.50^{d} \pm 0.17$
G6 Rats + bay leaves (5%)	$87.50^{f} \pm 0.11$	$83.80^{e} \pm 0.12$
G7 Rats with mixture (2.5%)	$99.05^{d} \pm 0.10$	$82.10^{e} \pm 0.13$
G8 Rats with mixture (5%)	$78.50^{g} \pm 0.15$	$73.50^{f} \pm 0.10$

Each value is represented as mean ± standard deviation (n = 3). Mean under the same column subscribed with different letters are significantly different (P≤0.05).

Data presented in Table (4) showed Effect of nutmeg, bay leaves and their mixtures on lipid profile level of diabetic rats. The obtained results showed that HDL-c (mg/dl) % of negative control recorded the higher value when compared with positive control with significant difference. The mean values were 49. 50 and 25. 55 %, respectively. From diabetic rat groups, it is clear to notice that the highest HDL-c(mg/dl) % recorded for 5% mg/kg mixture, while the lowest HDL-c (mg/dl) % recorded for 2, 5 nutmeg% turnip roots with significant difference (P≤0.05). The mean values were 47. 00 and 34. 00 %, respectively.

Data presented in Table (4) showed Effect of nutmeg, bay leaves and their mixtures on lipid profile level of diabetic rats. The obtained results showed that In case of LDL-c (mg/dl) % of positive control recorded the higher value when compared with negative control with significant difference. The mean values were102. 95 and 10. 23 %, respectively. From diabetic rat groups, it is clear to notice that the highest LDL-c (mg/dl) % recorded for 2.5 mg/kg nutmeg, while the lowest LDL-c (mg/dl) % recorded for 5 % mixture with significant difference (P≤0.05). The mean values were 68. 85 and 17. 80%, respectively

Data presented in Table (4) showed Effect of nutmeg, bay leaves and their mixtures on lipid profile level of diabetic rats. The obtained results showed that VLDL-c (mg/dl) % of positive control recorded the higher value when compared with negative control with significant difference. The mean values were 26. 50 and 13. 02 %, respectively. From diabetic rat groups, it is clear to notice that the highest VLDL-c (mg/dl) % recorded for 2.5 mg/kg nutmeg, while the lowest VLDL-c (mg/dl) % recorded for 5 % mixture with significant difference (P≤0.05). The mean values were 23. 65 and 14. 70 %, respectively. These results are in agreement with the obtained by **(29)** resulted in they reported that a significant decrease in the blood lipid profile, glycemic profile and liver enzymes, with reduced levels of ALT and AST, VLDL, glucose, total cholesterol, LDL cholesterol, triglycerides and increased HDL cholesterol, present research underline that the dietary treatment with bay leaves meal, in the extend of 1 g/kg feed.

Data presented in Table (5) showed effect of nutmeg, bay leaves and their mixtures on kidney functions of diabetic rats. The obtained results showed that Urea (mg/dl) % of positive control recorded the higher value when compared with negative control with significant difference. The mean values were 35. 65 and 20. 70 %, respectively. From diabetic rat groups, it is clear to notice that the highest Urea (mg/dl) % recorded for 5% mg/kg bay leaves, while the lowest urea (mg/dl) % recorded for 5 % mixture with significant difference (P≤0.05). The mean values were 31. 35 and 22. 38 %, respectively. These results are agreement with the obtained by **(30)** Bay leaves has valuable effect on blood glucose level and ameliorative effect on regeneration of pancreatic islets, it also

restored the altered liver enzymes, urea, creatine kinase, total protein levels, calcium and ferritin to near normal.

Table (4): Effect of nutmeg, bay leaves and their mixtures on lipid profile level of diabetic rats.

Treatment/Parameter	HDL-c (mg/dl)	LDL-c (mg/dl)	VLDL-c (mg/dl)
G1 Control group (-)	$49.50^{a}\pm0.17$	$10.23^{g}\pm0.11$	$13.02^{e}\pm0.10$
G2Control group (+)	$25.55^{e}\pm0.10$	$102.95^{a}\pm0.17$	$26.50^{a}\pm0.17$
G3 Rats + nutmeg (2.5%)	$34.00^{d}\pm0.12$	$68.85^{b}\pm0.16$	$23.65^{b}\pm0.15$
G4 Rats + nutmeg (5%)	$38.75^{c}\pm0.13$	$48.80^{c}\pm0.15$	$18.95^{c}\pm0.14$
G5 Rats + bay leaves (2.5%)	$36.05^{c}\pm0.11$	$41.95^{d}\pm0.12$	$17.50^{c}\pm0.12$
G6 Rats + bay leaves (5%)	$41.15^{c}\pm0.14$	$31.84^{e}\pm0.13$	$16.76^{d}\pm0.10$
G7 Rats with mixture (2.5%)	$45.50^{b}\pm0.15$	$38.58^{d}\pm0.16$	$16.42^{d}\pm0.13$
G8 Rats with mixture (5%)	$47.00^{a}\pm0.16$	$17.80^{f}\pm0.13$	$14.70^{e}\pm0.11$

Each value is represented as mean ± standard deviation (n = 3). Mean under the same column subscribed with different letters are significantly different (P≤0.05).

Data presented in Table (5) showed effect of nutmeg, bay leaves and their mixtures on kidney functions of diabetic rats. The obtained results showed uric acid (mg/dl) % of positive control recorded the higher value when compared with negative control with significant difference. The mean values were 10. 05 and 6. 25 %, respectively. From diabetic rat groups, it is clear to notice that the highest uric acid (mg/dl) % recorded for 5% mg/kg bay leaves, while the lowest Uric acid (mg/dl) % recorded for 5 % mixture with significant difference (P≤0.05). The mean values were 8. 30 and 6. 80 %, respectively.

These results are agreement with the obtained by [31] showed that the influence of bay leaves boiled water towards levels of uric acid (uric acid) in hyper uricemia patients in the village Joho. Treatment of bay leaves boiled water can support the synthetic chemical treatments to accelerate the healing process of patients with gout. Therefore, the use of bay leaves boiled water should be recommended by health professionals to patients with gout.

Data presented in Table (5) showed effect of nutmeg, bay leaves and their mixtures on kidney functions of diabetic rats. The obtained results showed creatinine (mg/dl) % of positive control recorded the higher value when compared with negative control with significant difference. The mean values were 1. 55 and 1. 01 %, respectively. From diabetic rat groups, it is clear to notice that the highest creatinine (mg/dl) % recorded for 5% mg/kg bay leaves, while the lowest Creatinine (mg/dl) % recorded for 5 % mixture with significant difference (P≤0.05). The mean values were 1. 36 and 1. 04%,

respectively. These results in agreement with the obtained by [30] bay leaves valuable effect on creatinine to med normal.

Table (5): Effect of nutmeg, bay leaves and their mixtures on kidney functions of experimental rats

Treatment/Parameter	Kidney functions		
	Urea (mg/dl)	Uric acid (mg/dl)	Creatinine (mg/dl)
G1 Control group (-)	20.70^{f}±0.12	6.25^{c}±0.10	1.01^{a}±0.13
G2Control group (+)	35.65^{a}±0.16	10.05^{a}±0.15	1.55^{a}±0.16
G3 Rats + nutmeg (2.5%)	24.81^{d}±0.13	6.90^{c}±0.11	1.05^{a}±0.14
G4 Rats + nutmeg (5%)	28.45^{c}±0.14	7.95^{b}±0.14	1.25^{a}±0.15
G5 Rats + bay leaves (2.5%)	29.55^{c}±0.14	7.60^{b}±0.13	1.11^{a}±0.13
G6 Rats + bay leaves (5%)	31.35^{b}±0.15	8.30^{b}±0.12	1.36^{a}±0.14
G7 Rats with mixture (2.5%)	29.90^{b}±0.12	7.80^{b}±0.11	1.15^{a}±0.10
G8 Rats with mixture (5%)	22.38^{e}±0.11	6.80^{c}±0.10	1.04^{a}±0.12

Each value is represented as mean ± standard deviation (n = 3). Mean under the same column subscribed with different letters are significantly different (P≤0.05).

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التأثير المحتمل لجوز الطيب وأوراق الغار في الفئران المصابه بالسكر المستحث بالألوكسان

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الملخص العربى:

صممت الدراسة الحالية لتحديد تأثير جوز الطيب وأوراق الغار في الفئران المصابة بمرض السكر المستحث بالألوكسان على الفئران المصابة بارتفاع سكر الدم. 48 من ذكور الفئران البيضاء الالبينو التي تزن 140-150 جم صنفت عشوائيا إلى ثماني مجموعات. 6 فئران كمجموعة ضابطة سلبية تغذت على نظام غذائي أساسي فقط بينما تم حقن 42 فأر أخرى بجرعة واحدة من الألوكسان: (150 مجم / كجم من وزن الجسم) للحث على مرض السكر، تم إعادة تصنيف هذه الفئران إلى6فئران مجموعة ضابطة إيجابية ، ستة لكل مجموعه من الفئران الفئران المعاملة 2.5 و 5٪ جوزة الطيب و 2.5 و 5٪ أوراق الغار 2.5 و 5٪ خليط من أوراق الغار وجوزة الطيب. كانت فترة الدراسة 28 يومًا. أشارت نتائج البيانات التي تم الحصول عليها إلى أن الاعشاب المختبرة ($P\leq0.05$) أدت إلى انخفاض نسبة الجلوكوز في الدم و VLDL في الدم وزيادة HDL مقارنة بالمجموعة الضابطة الموجبة كما أدت الاعشاب المختبرة إلى تحسين وظائف الكبد والكلى و أظهرت النتائج المتحصل عليها ان جوزالطيب وأوراق الغار تحتوي على عدة مركبات قادرة على تحسين الآثار الضارة وتحسين مستوي السكرفي الفئران المصابة بارتفاع مستوي السكر في الدم.

الكلمات المفتاحية : الفئران ,التوابل ,التحاليل الكيميائية الحيوية ,سكر الدم