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Effect of Burdock (Arctium lappa) Roots and Basil (Ocimum basilicum) Leaves in Alloxan–Induced Diabetic Rats

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Abstract

The prevalence of diabetes and its consequences has increased over the past several decades, and it is expected that it will double in the upcoming years. Diabetes problems are significantly influenced by chronic hyperglycemia, which is identified by highly advanced glycation end products. The purpose of the study was to investigate the effect of different concentrations 2 and 4% of basil leaves and burdock roots, as well as their mixture as powder, on glucose levels in diabetic rats. A total of 48 rats were used in this experiment, which were divided into eight groups of six rats each. Alloxan was used to induce rat's diabetic. Biochemical tests were performed to evaluate glucose levels, total cholesterol, triglycerides, high density lipoprotein cholesterol (HDL-c), low density lipoprotein cholesterol (LDL-c), low-density lipoprotein cholesterol (VLDL-c), as well as liver and kidney functions. Results showed that rats fed on 4 % mixture powder recorded the lowest glucose level with significant differences being119.25 mg/dl. Data also indicated that rats fed on powder basil leaves, burdock roots, or their mixture increased HDL-c significantly ($P \leq 0.05$) and improved kidney and liver functions by lowering ALT, AST, ALP, creatinine, uric acid, and urea level. In conclusion, a 4% powdered blend of basil leaves and burdock roots improves all biochemical studies, especially glucose levels.

Key words: Plants leaves and roots, Rats, Glycemic, Biochemical analysis.

Introduction

The World Health Organization defines diabetes mellitus (DM) as a serious, chronic condition that arises when the pancreas fails to generate enough insulin or when the body is unable to utilize the insulin that is produced. Consequently, it is a significant public health issue **(1)**. It is a metabolic disorder that equally affects people from all racial and ethnic origins, has overtaken tobacco usage as the world's biggest cause of death, and is escalating like an epidemic. It comes in a variety of forms that are classed in accordance with various pathophysiology's and is characterized by high blood glucose levels **(2)**. One of the most common diseases, diabetes was caused by high blood glucose or glucose levels in the body. The most vital source of energy for the human body, glucose in the blood gives it the power it requires to do the entire work. Insulin, which is created with the pancreas' help and receives its energy from the ingestion of food, provides this energy. The functioning of the entire body is affected after a patient is diagnosed with diabetes since the glucose is unable to reach any cells in the body **(3)**. It has become one of the most dangerous and prevalent chronic diseases of our day, lowering life expectancy and creating life-threatening, disabling, and expensive complications **(4)**. The prevalence of diabetes and its consequences has increased over the past several decades, and it is expected that it will double in the upcoming year. Diabetes problems are significantly influenced by chronic hyperglycemia, which is identified by highly advanced glycation end products **(5)**. The most prevalent kind of diabetes, type 1, is brought on by insufficient insulin production in the body. Low insulin production is a common occurrence in the diabetic population and is caused by both immune system attack and loss of pancreatic function. The research indicates that both children and adults can get this type of diabetes. The next stage of diabetes is type 2, which develops when the body's insulin is not utilized properly. Although it can affect people of any age, adults in their middle years are the most common age group to get this kind of diabetes. Type 2 diabetes is linked to obesity, fatigue, insulin resistance, low glucose tolerance, and gestational diabetes. Other type 2 hazards include age, insulin resistance, sedentary behavior, and nationality **(6)**.

Arctium lappa, originally from Asia and Europe, also known as burdock, gobo (in Japan), and bardane (in France and Italy), is a medicinal plant from the Asteraceae family. It is widely grown and has been altered to grow in various climates and continents **(7)**. Several bioactive polyphenols, including chlorogenic acid and its derivatives, are present in the burdock as medicinal plant **(8)**. Around 80% of illnesses are treated worldwide with herbal medications, which have positive benefits on health. Different bioactive polyphenols found in some of these herbal plants such as burdock have drawn interest for the treatment of diabetes **(9)**. Burdock root extract contains phenols, flavonoids, alkaloids, and saponins, and evidence from in vitro experimental research indicates that phenolic compounds inhibit -amylase and -glucosidase activities in a dose-dependent way. **(10)**. Because extracts from *A. lappa* roots contain many active elements, they can enhance the functioning of beta cells. Fructo-oligosaccharide is an effective dietary protective compound that can successfully inhibit the activity of -amylase and -glucosidase enzyme, reducing the blood glucose and bilirubin levels while promoting creatinine excretion, and increasing blood urea nitrogen and uric acid as well as the high-density lipoprotein cholesterol levels. These and other convincing results from numerous studies have demonstrated this **(11)**. Total lignan from burdock fruit has been demonstrated to exert anti-diabetic effect in a model of alloxan-induced diabetes in mice and rats. It has been proven that burdock lignan is a secure and reliable diabetic medication. Additionally, inulin, a type of naturally occurring carbohydrate found in burdock root, may be able to regulate blood sugar levels by interacting with cell surface receptors **(12)**.

The aromatic herb known as basil (*Ocimum basilicum*, L.) is also known as sweet basil, Tulsi in Hindi, Holy basil in English, and Rehan in Egypt. It is frequently employed in traditional medicine to cure a variety of illnesses **(13)**. Basil's phenolic content, which includes flavonoids, phenolic acids, rosmarinic acid, and aromatic chemicals, is primarily responsible for its antioxidative effects **(14)**. The antioxidant disrupts the free radical cycle of oxidation and produces stable free radicals that do not initiate or propagate additional lipid oxidation by donating hydrogen from the hydroxyl groups of phenol **(15)**. Basil reduced renal glucose reabsorption and/or inhibited hepatic glucose production to enhance insulin action or accelerate the utilisation of glucose by peripheral tissues to lower blood glucose levels **(16)**. Basil has been shown in clinical trials to increase blood pressure, improve insulin sensitivity, and lower blood sugar levels in Type 2 diabetic patients **(17)**. According to **(18)**, basil leaves increase the pancreatic release of insulin by lowering liver glucose production and enhancing glycogen synthesis. They also exhibit anti-hyperglycaemic and liver-protective characteristics. In diabetic rats given metformin or basil leaves at doses of 100, 200, or 400 mg/kg body weight, an extract of the leaves showed a decrease in blood glucose levels **(19)**. Thus, basil leaves can be utilized to lower blood sugar levels.

The purpose of this investigation was to determine how different concentrations (2 and 4%), in powder form, of burdock root, basil leaves, and their combination affected some biochemical and biological complications in diabetic rats.

Material and Methods

Materials

Source of burdock roots, and basil leaves

The burdock (*Arctium lappa*) roots and basil (*Ocimum basilicum*) leaves were purchased at the herbalist in Cairo City, Cairo Governorate, Egypt.

Alloxan

Alloxan, also known as 5, 5-dihydroxyl pyrimidine-2, 4, 6-trione, is an organic molecule, urea derivative, carcinogen, and cytotoxic glucose derivative obtained by Al-Gomhoria Company for Trading Drugs, Chemicals, and Medical Instruments in Cairo, Egypt.

Experimental animals

Vaccine and Immunity Organization, Ministry of Health, Helwan Farm, Cairo, Egypt provided a total of 48 adult normal male albino rats "Sprague Dawley" strain weighing 150±10 g.

The chemicals and kits

SIGMA Chemical Co., Egypt, provided pure white crystalline cholesterol powder. Morgan Co. Cairo, Egypt provided casein, cellulose, choline chloride powder, and DL methionine powder. Al-Gomhoria Company for Trading Drugs, Chemical and Medical Instruments, Cairo, Egypt, provided the chemical kits (TC, TG, HDL-c, ALT, AST, ALP, urea, uric acid, and creatinine) utilized in this examination.

Methods

Preparation of burdock roots, and basil leaves

The dried burdock roots, and basil leaves were ground to a fine powder in an air mill, then mixed with a high-speed mixer (Molunix, Al-Araby Company, Benha, Egypt) and served as powder seize.

The induction of experimental diabetes:

According to **(19)** method, diabetes was induced in normal healthy male albino rats by injecting 150 mg/kg body weight of alloxan intraperitoneally.

Fasting blood samples were taken one week after alloxan injections to measure fasting serum glucose 200 mg/dl in diabetes rats **NDDG, (20)**.

Experimental design:

The study was carried out and approved at Animal House, Department of Nutrition and Food Science, Faculty of Home Economics, Menoufia University, Egypt.

In this experiment, 48 adult male white albino rats, "Sprague Dawley" strain, 10 weeks old, weighing (150±10g), were used. For adaptation, all rats were fed a basal diet (casein diet) prepared according to **(21)** for 7 days. After this adaptation period, rats were divided into 8 groups, six rats per each as follows: group (1): rats fed on basal diet only as negative control. Group (2): Diabetic rats fed on basal diet only as a positive control group. Group (3): Diabetic rats fed on basal diet and burdock roots as powder by 2% of kg/diet/day. Group (4): Diabetic rats fed on basal diet and burdock roots as powder by 4 % of kg/diet/day. Group (5): Diabetic rats fed on basal diet and basil leaves as powder by 2% of kg/diet/day. Group (6): Diabetic rats fed on basal diet and basil leaves as powder by 4 % of kg/diet/day. Group (7): Diabetic rats fed on basal diet and mixture (1:1) of burdock roots and basil leaves as powder by 2% of kg/diet/day. Group (8): Diabetic rats fed on basal diet and mixture (1:1) of burdock roots and basil leaves as powder by 4% of kg/diet/day. The experiment continued for 28 days, at the end of the experimental period each rat weight separately, then slaughtered and blood samples were collected.

Blood sampling

At the end of the experiment period (28 days), rats were fasted for 12-h then rats were scarified. Blood samples were collected from the portal vein into dry clean centrifuge tubes for serum separation, blood samples centrifuged for 10 minutes at 4000 rpm to separate, the serum **(22)**. Serum samples were frozen at -18 $^{\circ}$C until chemical analysis.

Biochemical analysis

Serum glucose was measured using the modified kinetic method **(23)** by using kit supplied by spin react. Spain.

The serum alanine aminotransferase (ALT), serum aspartate aminotransferase (AST), and serum alkaline phosphatase (ALP) were measured using the methods described by **(24); (25) and (26)**, respectively.

Serum total cholesterol was determined according to the colorimetric method described by **(27)**. Serum triglycerides was determined by enzymatic method using kits according to **(28) and (29)**. HDL-c was determined according to the method described by **(30)** and **(31)**. VLDL-c was calculated in mg/dl according to **(32)** using the following formula: VLDL-c (mg/dl) = Triglycerides / 5. LDL-c was calculated in mg/dl according to **(32)** as follows: LDL-c (mg/dl) = Total cholesterol – (HDL-c + VLDL-c).

According to the method, serum urea and serum creatinine were determined using an enzymatic technique **(33) and (34)**. While serum uric acid was measured using a calorimeter using the method of **(35)**.

Statistical analysis

The data were analyzed using a completely randomized factorial design **(36)** 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.

Results and Discussion

Effect of burdock roots and basil leaves and their mixtures on glucose level of diabetic rats

Data shown in Table (1) demonstrates how basil leaves and burdock roots affect the blood glucose levels of diabetic rats. The obtained results showed a significant difference ($P \leq 0.05$) between the highest glucose level recorded for the positive control group and the lowest level reported for the negative control group. The mean values were 253.0 and 92.25 mg/dl, respectively.

On the other hand, rats fed on 4% mixture of burdock roots and basil leaves recorded the lowest glucose level with significant differences ($P \leq 0.05$) being, 119.25 mg/dl. While the highest glucose level in diabetic rats recorded for 2% burdock roots with significant differences ($P \leq 0.05$). The mean value was 145.0 mg/dl. It could be concluded that 5% mixture of burdock roots and basil leaves showed the highest reduction in glucose level. These findings concur with those of **(37)**, who noted a significant relationship between basil oral dosages of 2 and 4 mg/kg and decreased blood glucose levels in diabetic rats. Basil significantly reduced blood glucose levels 24 hours after the initial dosage, and this effect persisted for 24 hours, 48 hours, and 72 hours, respectively.

Additionally, according to **(38)**, burdock roots contain polysaccharides, polyphenols, flavonoids, and polyunsaturated fatty acids that have biological and pharmacological properties including anti-diabetic. Burdock roots contain considerable amounts of polysaccharides, particularly high quantities of the dietary fiber inulin.

Table (1): Effect of burdock roots and basil leaves and their mixtures on glucose level of diabetic rats:

Treatment/Parameter	Glucose level (mg/dl)
G1 Control group (-)	$92.25^{f}\pm0.13$
G2Control group (+)	$253.0^{a}\pm0.11$
G3 Rats + 2% burdock roots	$145.0^{b}\pm0.14$
G4 Rats + 4%burdock roots	$143.9^{b}\pm0.10$
G5 Rats +2% basil leaves	$139.25^{c}\pm0.12$
G6 Rats + 4% basil leaves	$136.25^{d}\pm0.15$
G7 Rats + 2%mixture	$135.25^{d}\pm0.13$
G8 Rats + 4% mixture	$119.25^{e}\pm0.11$
LSD (P≤0.05)	**2.423**

Each value represents the mean ± SD of three replicates.
Means in the same column with different letter are significantly different (P<0.05).

Effect of burdock roots and basil leaves and their mixtures on liver functions of diabetic rats:

The effects of burdock roots and basil leaves on the liver functions (ALT, AST, and ALP) of diabetic rats are shown by the data in Table 2. It is obvious to see that the positive control group of rats recorded the highest value for the ALT liver enzyme when compared to the negative control group, with a significant difference (P≤0.05). The mean values were 93.40 and 30.45 U/L, respectively. While the highest ALT liver enzyme of diabetic group recorded for group fed on 4% basil leaves but, the lowest value recorded for 4% mixture of basil leaves and burdock roots with a significant difference (P≤0.05). The mean values were 72.50 and 54.95 U/L, respectively.

As for AST, the positive control group of rats reported the highest value for the liver enzyme AST, with a difference that was statistically significant

(P≤0.05). The mean values were 74.80 and 19.70 U/L, respectively. There was a significant difference (P≤0.05) between the lowest value for the 4% mixture of basil leaves and burdock roots and the highest value for the diabetic group's AST liver enzyme when they consumed 4% basil leaves. The mean values were 51.45 and 26.45 U/L, respectively.

When compared to the negative control group, the positive control group of rats' ALP liver enzyme recorded the highest value with a statistically significant difference (P≤0.05). The mean values were 72.25 and 30.80 U/L, respectively. While the highest ALP liver enzyme of diabetic group recorded for group fed on 4% basil leaves but, the lowest value recorded for 4% mixture of basil leaves and burdock roots with a significant difference (P≤0.05). The mean values were 55.50 and 38.35 U/L, respectively. These findings support the finding of **(39)** that the antioxidant activity of *O. basilicum*'s flavonoids may be responsible for the plant's hepatoprotective effects.

Additionally, according to **(40)**, burdock roots cleanse the liver by enhancing the activities of liver enzymes against ethanol, carbon tetrachloride (CCl_4), acetaminophen, cadmium, and zinc oxide. Burdock roots' benefits on liver enzymes and blood detoxification may be attributed to their antioxidant, anti-inflammatory, and prebiotic properties.

Table (2): Effect of burdock roots and basil leaves and their mixtures on liver functions of diabetic rats

Treatment/Parameter	Liver functions		
	AST (U/L)	ALT (U/L)	ALP (U/L)
G1 Control group (-)	19.70^{g}±0.11	30.45^{f}±0.10	30.80^{e}±0.12
G2Control group (+)	74.80^{a}±0.15	93.40^{a}±0.16	72.25^{a}±0.14
G3 Rats + 2% burdock roots	31.60^{e}±0.10	57.70^{e}±0.12	39.60^{d}±0.13
G4 Rats + 4%burdock roots	45.45^{c}±0.14	61.40^{d}±0.13	40.35^{d}±0.15
G5 Rats +2% basil leaves	41.60^{d}±0.12	65.30^{c}±0.11	48.65^{c}±0.10
G6 Rats + 4% basil leaves	51.45^{b}±0.11	72.50^{b}±0.10	55.50^{b}±0.12
G7 Rats + 2%mixture	45.35^{c}±0.13	61.50^{d}±0.15	48.40^{c}±0.13
G8 Rats + 4% mixture	26.45^{f}±0.15	54.95^{e}±0.13	38.35^{d}±0.11
LSD (P≤0.05)	3.152	3.570	2.360

Each value represents the mean ± SD of three replicates.
Means in the same column with different letter are significantly different (P<0.05).

Effect of burdock roots and basil leaves and their mixtures on total cholesterol and triglyceride of diabetic rats

The effect of basil and burdock roots on the serum total cholesterol and triglycerides of diabetic rats are shown in Table (3). The obtained results revealed a significant difference between the cholesterol levels of the positive control group and the negative control group, with the positive control group recording the highest value (P≤0.05). The mean values were 155.0 and 72.75 mg/dl, respectively. While the highest cholesterol levels recorded for diabetic group fed on 2% burdock roots but, the lowest value recorded for 4% mixture of basil and burdock roots with a significant difference (P≤0.05). The mean values were 126.50 and 80.50 mg/dl, respectively .

Regardless of the significant difference between the two control groups, the triglyceride of the positive control group had the highest value ($P \leq 0.05$). The mean values were 132.50 and 65.10 mg/dl, respectively. While the highest triglyceride recorded for diabetic group fed on 2% burdock roots but, the lowest value recorded for 4% mixture of basil leaves and burdock roots with a significant difference ($P \leq 0.05$). The mean values were 118.25 and 73.50 mg/dl, respectively. These findings concur with those of **(41)** who claimed that administering purple basil treated hyperlipidemia by reducing levels of triglycerides and total cholesterol.

Additionally, **(42)** reported that the use of burdock lowered the levels of blood triglycerides (TG) and total cholesterol (TC).

Table (3): Effect of burdock roots and basil leaves and their mixtures on total cholesterol and triglyceride of diabetic rats

Treatment/Parameter	Total cholesterol (mg/dl)	Triglyceride (mg/dl)
G1 Control group (-)	$72.75^{h}\pm0.14$	$65.10^{g}\pm0.15$
G2Control group (+)	$155.0^{a}\pm0.13$	$132.50^{a}\pm0.13$
G3 Rats + 2% burdock roots	$126.50^{b}\pm0.14$	$118.25^{b}\pm0.11$
G4 Rats + 4%burdock roots	$106.50^{c}\pm0.15$	$94.75^{c}\pm0.14$
G5 Rats +2% basil leaves	$95.50^{e}\pm0.12$	$87.50^{d}\pm0.17$
G6 Rats + 4% basil leaves	$89.75^{f}\pm0.11$	$83.80^{e}\pm0.12$
G7 Rats + 2%mixture	$101.05^{d}\pm0.10$	$82.10^{e}\pm0.13$
G8 Rats + 4% mixture	$80.50^{g}\pm0.15$	$73.50^{f}\pm0.10$
LSD (P≤0.05)	**3.980**	**3.610**

Each value represents the mean ± SD of three replicates.

Means in the same column with different letter are significantly different ($P<0.05$).

Effect of burdock roots and basil leaves and their mixtures on lipid profile level of diabetic rats:

The effect of basil and burdock roots and their mixtures on the serum lipid profile (HDL-c, LDL-c and VLDL-c) level of diabetic rats are shown in

Table (4). The results showed a significant difference (P≤0.05) between the high-density lipoprotein (HDL-c) levels of the positive and negative control groups, with the negative control group recording a higher value. The mean values were 49.50 and 25.55 mg/dl, respectively. While the diabetic group received the greatest HDL-c levels (4% mixture of basil and burdock roots), the lowest value (2% burdock roots) was recorded with a significant difference (P≤0.05). The mean values were 48.00 and 34.00 mg/dl, respectively.

Low-density lipoprotein (LDL-c) values showed a significant difference between the positive and negative control groups, with the positive control group recording a higher value (P≤0.05). The mean values were 102.95 and 10.23 mg/dl, respectively. While the highest LDL-c levels recorded for diabetic group fed on 2% burdock roots but, the lowest value recorded for 4% mixtures of basil leaves and burdock roots with a significant difference (P≤0.05). The mean values were 68.85 and 17.80 mg/dl, respectively.

In case of very low-density lipoprotein (VLDL-c) levels, the positive control group recorded the higher value when compared with negative control group with a significant difference (P≤0.05). The mean values were 26.50 and 13.02 mg/dl, respectively. While the highest VLDL-c levels recorded for diabetic group fed on 2% burdock roots but, the lowest value recorded for 4% mixtures of basil leaves and burdock roots with significant difference (P≤0.05). The mean values were 23.65 and 14.70 mg/dl, respectively. These findings concur with those of **(42)** who claimed that the lipid profiles following oral administration of *A. lappa* extract showed the extract's ability to decrease cholesterol. Therefore, all other mechanisms than the lipid metabolism route may be responsible for the effect of weight increase. In diabetic mice, raising serum insulin levels is one possible defense against weight loss. Additionally, this study demonstrated that doses of burdock root extract result in weight gain in the control group in addition to having a protective impact on weight loss (healthy mice).

Additionally, (43) noted that when compared to varied levels of thyme or basil leaves each alone, obese rats given with 5% combinations of thyme and basil leaves had improved lipid profiles.

Table (4): Effect of basil and burdock roots and their mixtures on lipid profile of diabetic rats

Treatment/Parameter	HDL-c (mg/dl)	LDL-c (mg/dl)	VLDL-c (mg/dl)
G1 Control group (-)	49.50^{a} ±0.23	10.23^{h}±0.11	13.02^{f} ±0.10
G2Control group (+)	25.55^{f} ±0.12	102.95^{a}± 0.13	26.50^{a} ±0.15
G3 Rats + 2% burdock roots	34.00^{e}±0.15	68.85^{b}±0.15	23.65^{b} ±0.14
G4 Rats + 4%burdock roots	38.75^{d} ±0.20	48.80^{c}±0.10	18.95^{c} ±0.13
G5 Rats +2% basil leaves	36.05^{e}±0.12	41.95^{d}±0.14	17.50^{c} ±0.15
G6 Rats + 4% basil leaves	41.15^{c}±0.13	31.84^{f}±0.10	16.76^{d} ±0.12
G7 Rats + 2%mixture	46.50^{b}±0.14	38.58^{e}±0.12	16.42^{d} ±0.11
G8 Rats + 4% mixture	48.00^{a}±0.15	17.80^{g} ±0.13	14.70^{e} ±0.14
LSD (P≤0.05)	**2.820**	**2.890**	**1.830**

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

Effect of basil and burdock roots and their mixtures on kidney functions of diabetic rats

The effects of burdock roots, basil leaves, and their combinations on the renal functions (uric acid, urea, and creatinine) of diabetic rats are shown by the data in Table (5). It is obvious to see that there was a significant difference (P≤0.05) between the uric acid levels recorded by the positive control group and the negative control group. The mean values were 35.65 and 20.70 mg/dl, respectively. While the highest uric acid levels recorded for diabetic group fed on 4% basil leaves but, the lowest value recorded for 4% mixtures of basil leaves and burdock roots with a significant difference (P≤0.05). The mean values were 31.35 and 22.38 mg/dl, respectively.

Urea levels showed a significant difference between the positive control group and the negative control group, with the positive control group recording a higher value (P≤0.05). The mean values were 10.05 and 6.25 mg/dl, respectively. While the highest urea levels recorded for diabetic group fed on 4% basil leaves but, the lowest value recorded for group fed on 4% mixtures of basil and burdock roots with significant difference (P≤0.05). The mean values were 8.30 and 6.80mg/dl, respectively.

In case of creatinine levels, data showed that the positive control group recorded the higher value when compared with negative control group with a significant difference (P≤0.05). The mean values were 1.55 and 1.01 mg/dl, respectively. While the highest creatinine levels recorded for group fed on 4% basil leaves but, the lowest value recorded for group fed on (4%) mixtures of basil leaves and burdock roots with significant difference (P≤0.05). The mean values were 1.36 and 1.04 mg/dl, respectively. These findings support the findings of **(44)** that basil extract reduced serum levels of urea, creatinine, and uric acid in Wistar rats.

Additionally, **(45)** showed that burdock fructo-oligosaccharide (BFO) boosted cell viability and diminished cell apoptosis and oxidative damage caused by high glucose (HG) in NRK-52E cells, suggesting that the effect may be mediated through the Nrf2/HO-1 signaling pathway. Given the circumstances, our findings suggest that BFO might be a useful therapy option for diabetic nephropathy (DN) in clinical settings.

Table (5): Effect of burdock roots and basil leaves and their mixtures on kidney functions of diabetic rats

Treatment/Parameter	Kidney functions		
	Urea (mg/dl)	Uric acid (mg/dl)	Creatinine (mg/dl)
G1 Control group (-)	$20.70^{e}\pm0.14$	$6.25^{c}\pm0.13$	1.01 ± 0.11
G2Control group (+)	$35.65^{a}\pm0.11$	$10.05^{a}\pm0.10$	$1.55^{a}\pm0.13$
G3 Rats + 2% burdock roots	$24.81^{d}\pm0.13$	$6.90^{c}\pm0.11$	$1.05^{b}\pm0.14$
G4 Rats + 4%burdock roots	$28.45^{bc}\pm0.10$	$7.95^{b}\pm0.15$	$1.25^{b}\pm0.10$
G5 Rats +2% basil leaves	$29.55^{b}\pm0.12$	$7.60^{b}\pm0.12$	$1.11^{b}\pm0.12$
G6 Rats + 4% basil leaves	$31.35^{b}\pm0.15$	$8.30^{b}\pm0.10$	$1.36^{b}\pm0.15$
G7 Rats + 2%mixture	$29.90^{b}\pm0.10$	$7.80^{b}\pm0.13$	$1.15^{b}\pm0.11$
G8 Rats + 4% mixture	$22.38^{e}\pm0.13$	$6.80^{c}\pm0.14$	$1.04^{b}\pm0.10$
LSD ($P\leq0.05$)	**2.024**	**0.957**	**0.449**

Each value is represented as mean ± standard deviation (*n* = 3).
Mean under the same column bearing different superscript letters are different significantly ($P\leq0.05$).

Conclusion: ....

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تأثير جذور الأرقطيون وأوراق الريحان على الفئران المصابة بالسكر المستحث بالألوكسان

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الملخص العربى

ازداد انتشـار مرض السـكر وعواقبه خلال العقود العديدة الماضـية ، ومن المتوقع أن يتضـاعف في السـنوات المقبلة. تتأثر مشـاكل مرض السـكر بشـكل كبير بزيادة مستوى سـكر الدم إلى الحد المزمن ، والذي يتم تحديده بواســطة منتجات نهائية متقدمة للغاية. الهدف من الدراســة هو معرفة تأثير التركيزات المختلفة ٢ ، ٤٪ لأوراق الريحان وجذور الأرقطيون وكذلك خليطهم كمسـحوق على مسـتويات الجلوكوز في الفئران المصـابة بمرض السـكر. تم اسـتخدام ما مجموعه ٤٨ فأرا في هذه التجربة ، والتي تم تقسـيمها إلى ثماني مجموعات من ستة فئران لكل منها. تم استخدام الألوكسان للحث على حدوث مرض السكر لدى الفئران. تم إجراء الاختبارات البيوكيميائية لتقييم مسـتويات الجلوكوز ، والكوليسـترول الكلي ، والدهون الثلاثية ، والبروتين الدهني عـالي الكثـافة (HDL-c) ، والبروتين الدهني منخفض الكثـافة (LDL-c) ، و البروتين الدهني منخفض الكثافة جدا (VLDL-c) ، وكذلك وظائف الكبد والكلى. أظهرت النتائج أن الفئران التي تم تغذيتها على مسحوق خليط ٤٪ سجلت أقل مستوى جلوكوز مع وجود فروق معنوية بلغت ١١٩,٢٥ ملجم / ديسيلتر. أشـارت البيانات أيضًـا إلى أن الفئران التي تتغذى على مسحوق أوراق الريحان أو جذور الأرقطيون أو خليطها أدت إلى زيادة معنوية ($P \leq 0.05$) بشــكل كبير فى مســتوى البروتين الدهني عالي الكثافة وكذلك تحسين وظائف الكلى والكبد عن طريق خفض انزيمات ALT ، AST ، ALP ،الكرياتينين ،حمض البوليك ،مســتوى اليوريا. في الختام ، أدى اســتخدام مســحوق مخلوط من أوراق الريحان وجذور الأرقطيونبتركيز ٤٪ على تحســين جميع التحاليل البيوكيميائية ، وخاصــة مستويات الجلوكوز.

الكلمات الدالة: أوراق وجذور النباتات، الفئران، السكر ، التحاليل الكيميائية الحيوية .