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Potential Effect of Turnip (Leaves and Root) on Alloxan-Induced Diabetic Rats

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Abstract:

The present study was designed to determine the effect of turnip leaves and roots on hyperglycemic rats. Thirty-two adult albino male rats Sprague –Dawley strain weighing 150-160 g were randomly classified into eight groups. Four rats served as a negative control group that fed on basal diet only, while the other twenty-eight rats were injected with a single intraperitoneal dose of Alloxan: (150 mg/kg body weight) to induce diabetes. These rats were reclassified into positive control group, six treated rat groups that were 2.5&5% turnip leaves powder, 2.5&5% turnip roots powder and, 2.5&5% mixture of turnip leaves and roots powder. The study period was 28 days. The results of the obtained data indicated that the tested plants ($P \leq 0.05$) resulted in decreased blood glucose and VLDL in the blood and increased HDL compared with the positive control group The tested plants also improved liver and kidney function and prevented some pathological histological changes in the pancreas. The hypothesis of the results obtained in which parts of the plant were tested contains several compounds capable of improving the adverse effects and discouraging mice suffering from excess blood sugar. In conclusion, the administration of turnip leaves and roots powder could ameliorate the health status of diabetic rats, and it could be recommended to use these plants, in moderate amounts in our diets.

Key words: Glucose, Lipides, Liver Function, Kidney Function, Hyperglycemia.

Introduction

Diabetes mellitus is a chronic metabolic disease characterized by hyperglycemia due to the impaired secretion and/or action of insulin (Chikhi et al., 2014). Its prevalence is increasing in many populations all over the world. In 2011, there were 366 million cases with diabetes, and it is expected to increase up to 522 million by 2030(Whiting et al., 2011). Hyperglycemia leads to alteration in metabolism of carbohydrate, protein, and fat (Wan et al., 2013). These metabolic disorders induce long term damages and dysfunction of various organs including eyes, kidneys, nerves, and blood vessels (Santaguida et al., 2005).There are multiple pharmacological interventions to reduce the hyperglycemia.

Therapy has been based on insulin or drugs that stimulate insulin secretion (sulphonylureas and rapid-acting secretagogues), reducing hepatic glucose production (biguanides), delaying digestion and absorption of intestinal carbohydrate (alpha-glucosidase inhibitors), or improving insulin action in thiazolidinediones(Grossman et al., 2013).Unfortunately, all of these therapies have various side effects such as gastrointestinal upset, weight changes, hypoglycemia, joint stiffness, kidney complications, and skin alterations (Soccio et al., 2014).

The prevalence of complementary and alternative medicine use among people with diabetes ranges from 17 to 72.8%. The most widely used therapies among diabetic populations are nutritional supplements, herbal medicine, nutritional advice, spiritual healing, and relaxation techniques. Evidence suggests that a high proportion of people with diabetes use these therapies concurrently with conventional health care services (Chang et al., 2007). Natural compounds have been proposed for prevention and/or treatment of diabetes. They act via insulin-like activity, promoting glucose transport, and glucose metabolism (Lee et al., 2006).

Plants of Brassicaceae family play a major role in worldwide vegetable production and consumption. Among them, Brassica rape (turnip) has been cultivated for many centuries across Europe expanding eventually to central and east Asia (Dixon, 2006). Turnip parts (root, leave, and seed) have been used in traditional medicine commonly for the treatment of some diseases such as diabetes Javadzadeh and Pouyan, 2010).

Turnip leaf contains biologically active compounds such as flavonoids including isorhamnetin, kaempferol and quercetin glycosides, phenyl propanoid derivatives, indole alkaloids, and sterol glucosides (Romani et al.,2006).Several studies have been reported that polyphenols and flavonoids have beneficial effects particularly on diabetes (Lim et al., 2006).

Turnip (Brassica rapa var. rapa) is a popular herbaceous plant grown worldwide. It is indigenous to Europe, Asia, America, and Russia and is now extensively developed as vegetable and oil source far and wide (Paul et al. 2019). It is a very old crop species exhibiting enormous morpho-diversity and occupying wide distribution throughout the world. Brassica is the most important genus of the Brassicaceae ancestry, a vast family of greens and vegetables that include various cultivated plants and wild species with extensively distinguished morphological attributes (kale, cabbage, broccoli, cauliflower, Brussels sprouts) (Martinez et al., 2010).

Turnip is consumed progressively as a prime source of needful nutrients by humans and constitutes an important crop globally (Bjorkman et al., 2011). Many species of this genus are grown for their greens, but most are grown commercially for market sale of the enlarged fleshy root because they are quite appreciated for the highly nutritive, dietetic, and against cancer-causing properties (Martinez et al., 2013).

Nowadays, the turnip has gained even greater interest for its anti-diabetic effect, due to the finding of numerous bioactive compounds such as flavonoids, phenylpropanoid derivatives, indole alkaloids and sterol glucosides (Romani et al., 2006a). Different classes of flavonoids have positive effects on diabetic patients in different ways (Podsedek et al., 2006). For instance, isorhamnetin plays a vital role in inhibiting the activity of aldose reductase, which is directly related to complications in diabetics. Likewise, kaempferol has an important anti-diabetic role by increasing glucose absorption in the rat muscles and lowering the glycemic level (Rajesh and Latha, 2014).

Epidemiological studies have indicated that intake of natural antioxidants from foods (fruits and vegetables) improves health and lowers mortality rate due to cancers and other degenerative diseases. Brassicaceous plants (Brassica rapa) are consumed in large quantities because of high dry matter digestibility and vital secondary metabolites like glucosinolates, isothiocyanates, flavonoids, isoflavones, polyphenols, carotenes, anthocyanins, zeaxanthins, folacin, selenium, lutein, and ascorbic acid. These secondary metabolites have high antioxidant capacity and play an imperative protective role against different types of cancers and cardiovascular and other degenerative diseases resulting from various factors by inhibiting the negative effects of free radicals (Haliloglu et al., 2012).

The flavonoid compounds are secondary metabolites extensively distributed in Brassica species in the form of glycosides. The Brassica genus is relatively high in flavonoids and other bioactive compounds having positive effects on human health compared to other high-water-content vegetables. Flavonoids and hydroxycinnamic acids are the most widely recognized and heterogeneous groups of polyphenols in the Brassica genus. The percentage of phenolic compounds (flavonoids) varies from 57.71 to 38.99 µmol/g among the different parts of turnip, These compounds exhibit free radical quenching property by hindering the biological activation of cancer-causing compounds and by expanding the detoxification of reactive oxygen species (ROS) (Morales-Lopez et al., 2017).

Flavonoid-rich diet is vital for the healthy life because it protects against cardiovascular diseases, coronary artery diseases, pigmentation and other degenerative disease resulting from imbalance in antioxidant and other status of the persons (Crozier et al.,2016).

Materials and methods

Plant materials:

Turnips leaves and roots were purchased from the local market of Shibin El- Kom, washed and dehydrated at 60°c for 6 hrs then grinded to soft powder and kept in dusky Stoppard glass bottles.

Rats and diets:

Male albino rats weighing 150-160 g per each were purchased from Medical Insects Research Institute, Cairo, Egypt. Alloxan: Pure chemical obtained from Sigma(29 Mawardi Street - Qasr al-Aini - Cairo – Egypt) which was used to induce diabetes mellitus in rats.

Chemicals:

The basal diet in the experiment consisted of casein (10%), corn oil (10%) vitamin mixture (1%), salt mixture (4%), choline chloride (0.2%), methionine (0.3%), cellulose (5%) and the remained is corn starch (69.5%) according to (Campbell, 1963) presented in the table (1), salt mixture and vitamins mixture were prepared according to (Hegested et al., 1941) and (Campbell, 1961).

After adaptation period (one week), the rats were randomly classified into eight groups. four rats served as negative control group that fed on basal diet only while the other Twenty-eight rats were injected by a single intraperitoneal dose of Alloxan: (150 mg/kg body weight) to induce diabetes. These rats were reclassified into positive control group, six treated rat groups that were 2.5&5% turnip leaves powder, 2.5&5% turnip roots powder and, 2.5&5% mixture of turnip leaves and roots powder. The study period was 28 days

Experimental Design:

Thirty male albino rats, Sprague Dawley Strain, feed on basal diet for a week. And Then, divided equal groups: one and two as negative and positive group. Groups 3 and 4 feed on basal diet with turnip leaves powders by 2.5 and 5%, Groups 5 and 6 feed on basal diet with turnip roots powders by 2.5 and 5%, Groups 7 and 8 feed on basal diet with turnip leaves and roots powders by 2.5 and 5%

At the end of the experimental (4 weeks), rats were fasted for 12-h then scarified. Blood samples were collected from the portal vein into dry clean centrifuge tubes for serum separation, blood samples centrifuged for 10 minutes at 3000 rpm to separate the serum according to Drury and Wallington, (1980). Pancreas of sacrificed rats were kept in 10% formalin solution till processed for histopathological examination.

Serum glucose assay:

Serum glucose was determined using chemical kits according to (Trinder, 1969).

Liver functions assay:

Alanine Amino Transferase (ALT), Aspartate Amino Transferase (AST) and alkaline phosphatase (ALP) were determined according to the methods described by Tietz, (1976), Henary, (1974) and Moss, (1982) respectively.

Kidney functions assay

Urea, Creatinine and uric acid were determined according to the methods of Patton and Crouch (1977), Henary (1974), and Patton and Crouch (1977) respectively.

Serum lipid profile assay

Triglycerides, total cholesterol and high-density lipoprotein(HDL) were determined according to (Schmidt-Sommerfeld et al., 1981); (Fassati and Prencipe, 1982) and (Allain, 1974) respectively

Histopathological Examination:

Pancreas of the scarified rats washed in slain solution, dried by filter paper, weighted, and stored frozen in formalin solution 10% for histopathological testing according to method mentioned by, Drury and Wallington, (1980).

Statistical Analysis:

Data were expressed as mean ± standard deviation. In order to compare the groups. Analysis of Variance (ANOVA) test was used. Values at P≤0.05 were considered to be statistically significant according to (CoStat Software, Version 6.4 2008).

Results and Discussion

Data given in table (1) show the effect of turnip leaves and roots and their mixture on blood glucose of control and diabetic rats.

The obtained results indicated that the highest glucose level recorded for positive control group, while the lowest level recorded for negative control group with significant differences (P≤0.05). The mean values were 189.25 and 100.5 mg/dl, respectively.

On the other hand, rats fed on 5% mixture mg/kg turnip leaves and roots extract recorded the lowest glucose level with significant differences (P≤0.05) being, 111.25 mg/dl. While the higher glucose level in diabetic rats recorded for 2.5 % turnip leaves extract with significant differences (P≤0.05). The value was 155 mg/dl. These results are in agreement with Hassanpour et al., (2015) they report that significant elevation of glucose concentrations on the first day among investigation groups that received alloxan. After 14 days of administration, the extract at the dose of 400 mg/kg and positive control group that received metformin 50mg/kg significantly decreased (p<0.001) blood glucose concentration compared with diabetic control rats but there was not a significant decrease in group 4 that was treated with 200 mg/kg bw of the extract. On the 29th day, both doses of the extract and metformin significantly decreased (p<0.001) blood glucose levels when compared with diabetic control group.

Table (1): Effect of turnip leaves and roots on serum blood glucose of control and diabetic rats.

Variables	(1) negative control	(2) positive control	Turnip leaves (TL)		Turnip roots (TR)		mixture		LSD
			(3) 2.5%	(4) 5%	(5) 2.5%	(6) 5%	(7) 2.5%	(8) 5%	
	Mean± SD	Mean±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	(p≤ 0.05)
Glucose gm/dl	100.75f ±2.474	189.25a ±1.767	155b ±±5.656	150.5bc± 6.4	144cd± 4.9	141cd± 1.414	135.25d± 3.889	111.2e ±5.303	10.35
%change of positive control	-46.76	—	-18.09	-20,739	-23.910	-25.49	-28.533	-41.21	—

Each value is represented as mean ± standard deviation (n = 2) Mean under the same line bearing different superscript letters are different significantly (p ≤ 0.05).

Data given in Table (2) showed the effect of turnip leaves and roots and their mixture extracts on liver functions (AST) of diabetic rats. It is clear that , AST liver enzyme of positive control rats group recorded the highest value when compared with negative control group with significant difference (P≤0.05). The mean values were 47.25 and 19.66 U/L, respectively. While the highest AST liver enzyme of treated group recorded for group fed on 5 % turnip roots but, the lowest value recorded for group fed on 5% mixture roots and leaves extract with significant difference (P≤0.05). The mean values were 51.6 and 26.75 U/L, respectively. This is in agreement with Karthik and Ravikumar, (2011) who examine that that aqueous extract of turnip leaf in a dose-dependent manner caused significant reduction in the plasma AST levels were significantly increased in both doses even more than diabetic control group.

Data given in Table (3) showed the effect of turnip leaves and roots and their mixture extracts on liver functions (ALT) of diabetic rats. The obtained results indicated that the ALT liver enzyme of positive control rats group recorded the highest value when compared with negative control group with significant difference (P≤ 0.05).

Table(2): Effect of turnip leaves and roots and their mixture extracts on(AST)

Variables	(1) negative control	(2) positive control	Turnip leaves (T.L) (3) 2.5%	(4) 5%	Turnip roots (T.R) (5) 2.5%	(6) 5%	mixture (7) 2.5%	(8) 5%	L.S.D (p≤ 0.05)
	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	
AST U/L	19.6d ±3.9	74.25 ±7.4	31.6cd ±4.424	45.75b ±7.283	41.9bc ±3.959	51.6b ±6.363	45.5b ±7.636	26.7d ±1.626	13.10
%change of positive control	-73.5	—	-57.4	-39.1	-43.6	-30.5	-38.7	-63.9	—

Each value is represented as mean ± standard deviation (n = 2) Mean under the same line bearing different superscript letters are different significantly (p ≤ 0.05).

The mean values were 92.85 and 29.1 U/L, respectively. While the highest ALT liver enzyme of treated group recorded for group fed on 5 % turnip roots but, the lowest value recorded for group fed on 5% mixture extract with significant difference (P≤0.05). The mean values were 72 and 55 U/L, respectively. this is in agreement with Karthik and Ravikumar, (2011) who examine that that aqueous extract of turnip leaf in a dose-dependent manner caused significant reduction in the plasma ALT levels were significantly increased in both doses even more than diabetic control group.

Table (3) : Effect of turnip leaves and roots and their mixture extracts on(ALT)

L.S.D (p≤ 0.05)	mixture (8) 5%	(7) 2.5%	Turnip roots (TR) (6) 5%	(5) 2.5%	Turnip leaves (TL) (4) 5%	(3) 2.5%	(2) positive control	(1) negative control	Variables
	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	
11.003	55c ±4.2	61.75bc ±5.4	72b ±5.7	64.95bc ±5. 6	61.6bc ±3.7	57.56c ±3.2	92.85a ±5.4	29.1d ±4.2	ALT U/L
—	-40.8	-33.5	-22.4	-30.0	-33.7	-38.0	—	-86.7	%change of positive control

Each value is represented as mean ± standard deviation (n = 2) Mean under the same line bearing different superscript letters are different significantly (p ≤ 0.05).

Data given in Table (4) showed the effect of turnip leaves and roots and their mixture extracts on liver functions (ALP) of diabetic rats. It is clear that ALP liver enzyme of positive control rats group recorded the highest value when compared with negative control group with significant difference (P≤0.05). The mean values were 6.08and 2.68 U/L, respectively. While the highest ALP liver enzyme of treated group recorded for group fed on 5 % turnip roots but, the lowest value recorded for group fed on 5% mixture turnip leaves and roots extract with significant difference (P≤0.05). The mean values were 55.75 and 39 U/L, respectively. These results are in agreement with this is in agreement with Karthik and Ravikumar,2011 who examine that that aqueous extract of turnip leaf in a dose-dependent manner caused significant reduction in the plasma ALT levels were significantly increased in both doses even more than diabetic control group.

Table (4): Effect of turnip leaves and roots and their mixture extracts on(ALP)

L.S.D	mixture		Turnip roots (T.R)		Turnip leaves (T.L)		(2) positive control	(1) negative control	Variables
	(8) 5%	(7) 2.5%	(6) 5%	(5) 2.5%	(4) 5%	(3) 2.5%			
(p≤ 0.05)	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	
11.886	39cd ±4.1	48.8 bc ±5.7	55.75b ±5.4	48.85bc ±6.0	40.6 cd ±4.7	39.4cd ±5.6	71.7a ±6.1	29.1d ±2.7	ALP U/L
—	-45.606	-31.93	-22.245	-31.86	-43.4	-45.048	—	-59.414	%change of positive control

Each value is represented as mean ± standard deviation (n = 2) Mean under the same line bearing different superscript letters are different significantly (p ≤ 0.05).

Data presented in table (5) show the effect of turnip leaves and roots and their mixtures on serum creatinine of diabetic rats. It was clear to mention that the highest creatinine recorded for positive control rats group value when compared with negative control group with significant difference (P≤0.05). The mean values were 1. 46 and 1.01 mg/dl. While the highest creatinine level of treated group recorded for group fed on 5 % turnip roots but, the lowest value recorded for group fed on 5% mix with significant difference (P≤0.05). The mean values was 1.26 and 0.94 mg/dl.

Data presented in table (6) show the effect of turnip leaves and roots and their mixtures on serum creatinine of diabetic rats The mean value of uric acid of positive control rats' group which was higher than negative control group with significant differences (P≤0.05). The mean values were 9.97 and 6.2 mg/dl. On other hand , the highest uric acid of treated groups (diabetes groups) was recorded for 5 % turnip roots r group, while the lowest urea recorded for 5% mixture of turnip leaves and roots with significant differences (P≤0.05). The mean values were 8.2 and 6.7 mg/dl. The best treatment was recorded for group 8 (2.5% turnip leaves and 5% mixture of turnip leaves and roots) as compared to positive control group.

Table (5): Effect of turnip leaves and roots and their mixture extract on serum creatinine of control and diabetic rats

L.S.D (p≤ 0.05)	mixture		Turnip roots (T.R)		Turnip leaves (T.L)		(2) positive control	(1) negative control	Variables
	(8) 5%	(7) 2.5%	(6) 5%	(5) 2.5%	(4) 5%	(3) 2.5%			
	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	
0.370	0.94b ±0.084	1.06b ±0.113	1.26ab ±0.042	1.01b ±0.31	1.15ab ±0.056	1.01b ±0.056	1.46a ±0.268	1.01b ±0.098	Creatinine Mg/dl
—	-35.616	-27.39	-13.69	-30.82	-21.23	-30.82	—	-30.82	%change of positive control

Each value is represented as mean ± standard deviation (n = 2) Mean under the same line bearing different superscript letters are different significantly (p ≤ 0.05).

Table (6): Effect of turnip leaves and roots and their mixture extract on serum uric acid of control and diabetic rats

L.S.D (p≤ 0.05)	mixture		Turnip roots (T.R)		Turnip leaves (T.L)		(2) positive control	(1) negative control	Variables
	(8) 5%	(7) 2.5%	(6) 5%	(5) 2.5%	(4) 5%	(3) 2.5%			
	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	
3.022	6.7 ab ±0.565	7.7ab± 2.687	8.2ab ±1.838	7.5 ab± 0. 848	7.8ab± 0.424	6.925ab± 0. 954	9.975a± 0.176	6.2b± 0.989	Uric acid Mg/dl
—	-32.832	-22.807	-17.79	-24.812	-21.80	-30.57	—	-37.844	%change of positive control

Each value is represented as mean ± standard deviation (n = 2) Mean under the same line bearing different superscript letters are different significantly (p ≤ 0.05).

Data present in table (7) Effect of turnip leaves and roots and their mixture extract on serum urea of control and diabetic rats. It was clear to mention that the highest urea recorded for positive control rats' group, while the lowest urea recorded for negative control group with significant differences (P≤0.05). The mean values were 35.46 and 2.7 mg/dl. On the other hand, the highest urea of treated groups (diabetes groups) was recorded for 5 % turnip roots, while the lowest urea recorded for 5% turnip leaves with significant differences (P≤0.05). The mean values were 31.15 and 2.35 mg/dl

Table (7): Effect of turnip leaves and roots and their mixture extract on serum urea of control and diabetic rats.

L.S.D	Mixture		Turnip roots (T.R)		Turnip leaves (T.L)		(2) positive control	(1) negative control	
	(8) 5%	(7) 2.5%	(6) 5%	(5) 2.5%	(4) 5%	(3) 2.5%			
(p≤ 0.05)	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Variables
8.638	22.35bc ±0.947	29.8abc ±7.071	31.15ab ±3.889	29.4abc ±2.545	2.35abc± 3.606	25.325b c±3.57	35.46a ±2.74	20.7 c ±2.545	Urea Mg/dl
—	-36.97	-15.96	-12.15	-17.08	-93.22	-28.58	—	-41.62	%change of positive control

Each value is represented as mean ± standard deviation (n = 2) Mean under the same line bearing different superscript letters are different significantly (p ≤ 0.05).

The effect of turnip leaves and roots and its extracts on the serum total cholesterol of diabetic rats are shown in Table (8). The obtained results indicated that the cholesterol levels of positive control group recorded the highest value when compared with negative control group with significant difference (P≤0.05). The mean values were 154 and 76.5 mg/dl, respectively. While the higher cholesterol levels recorded for group fed on 5 % turnip leaves but, the lowest value recorded for group fed on 5% mixture leaves and roots extract with significant difference (P≤0.05). The mean values were 107.25 and 78.9 mg/dl, respectively.

The effect of turnip leaves and roots and its extracts on the serum triglycerides of diabetic rats are shown in Table (9) It is clear that , the triglyceride of positive control group recorded the higher value when compared with negative control group with significant difference (P≤0.05). The mean values were 132. 5 and 67.5 mg/dl, respectively. While the highest triglyceride recorded for group fed on 5 % turnip leaves but, the lowest value recorded for group fed on 5% mixture turnip leaves and roots extract with significant difference (P≤0.05). The mean values were 92.5 and 66 mg/dl, respectively.

Table (8): Effect of turnip leave and roots and its extracts on total cholesterol

L.S.D (p≤ 0.05)	mixture		Turnip roots (T.R)		Turnip leaves (T.L)		(2) positive control	(1) negative control	Variables
	(8) 5%	(7) 2.5%	(6) 5%	(5) 2.5%	(4) 5%	(3) 2.5%			
	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	
11.116	78.9de± 0.141	de80.75 1.76±	90cd ±3.53	96.75bc ±8.131	107.25b ±3.35	101.25bc ±7.42	154a ±5.65	76.5e ±12.12	Cholesterol. Mg/dl
—	-48.766	-47.56	-41.55	-37.17	-30.357	-34.25	—	-50	%change of positive control

Each value is represented as mean ± standard deviation (n = 2) Mean under the same line bearing different superscript letters are different significantly (p ≤ 0.05).

Table (9):Effect of turnip leave and roots and its extracts on serum triglycerides level of diabetic rats:

L.S.D (p≤ 0.05)	mixture		Turnip roots (T.R)		Turnip leaves (T.L)		(2) positive control	(1) negative control	Variables
	(8) 5%	(7) 2.5%	(6) 5%	(5) 2.5%	(4) 5%	(3) 2.5%			
	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	
6.631	66d ± 1.41	67 d ± 1.41	80.25 c ± 3.18	82.95 c ± 2.89	92.5 b ± 3.53	77.25 c ± 2.47	132.5a ± 3.53	67.5d ± 3.53	triglyceride mg/dl
—	-50.188	-49.433	-39.433	-37.396	-30.188	-41.698	—	-49.056	%change of positive control

Each value is represented as mean ± standard deviation (n = 2) Mean under the same line bearing different superscript letters are different significantly (p ≤ 0.05).

The effect of turnip leaves and roots and its mixture on the serum lipid profile (HDL-c) levels of diabetic rats are shown in Table (10). The obtained results indicated that the high-density lipoprotein (HDL-c) levels of negative control group recorded the higher value when compared with positive control group with significant difference (P≤0.05). The mean values were 52.4 and 36.35mg/dl, respectively. While the higher (HDL-c) levels recorded for group fed on 5% mixture turnip leaves and roots but, the lowest value recorded for group fed on 2.5 % turnip leaves with significant difference (P≤0.05). The mean values were 51.5 and 34.14 mg/dl, respectively.

Table(10) Effect of turnip leaves and roots and its mixture on high density lipoprotein cholesterol (HDL-c)

L.S.D (p≤ 0.05)	mixture		Turnip roots (T.R)		Turnip leaves (T.L)		(2) positive control	(1) negative control	Variables
	(8) 5%	(7) 2.5%	(6) 5%	(5) 2.5%	(4) 5%	(3) 2.5%			
	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	
17.935	51.5a ±2.12	34.5a ±19.79	48.25a ±1.76	43.5a ±3.53	39.5a ±1.41	34.14a ±5.44	36.35a ±5.161	52.4a ±3.676	HDL-c Mg/dl
—	41.67	-5.08	32.737	19.669	8.665	-6.079	—	44.15	%change of positive control

Each value is represented as mean ± standard deviation (n = 2) Mean under the same line bearing different superscript letters are different significantly (p ≤ 0.05).

Histopathological examination of Pancreas:

Histopathologically, pancreas of rat from group 1 showed no histopathological changes (photo a). However, pancreas of rat from group 2 showed atrophy of islets of Langerhans (photo b). On the other hand, pancreas of rat from group 3 revealed focal necrosis of pancreatic acini (photo c). Moreover, pancreas of rat from group 4 showed hypertrophy and hyperplasia of islets of pancreas (photo d). Meanwhile, sections from group 5 revealed necrosis of some cells of islets of Langerhans (photo e). Pancreas of rat from group 6 showed atrophy of islets of Langerhans (photo f). Examined sections of rat from group 7 revealed necrosis of islets of Langerhans (photo g). Moreover, pancreas of rat from group 8 showed no histopathological changes (photo h)

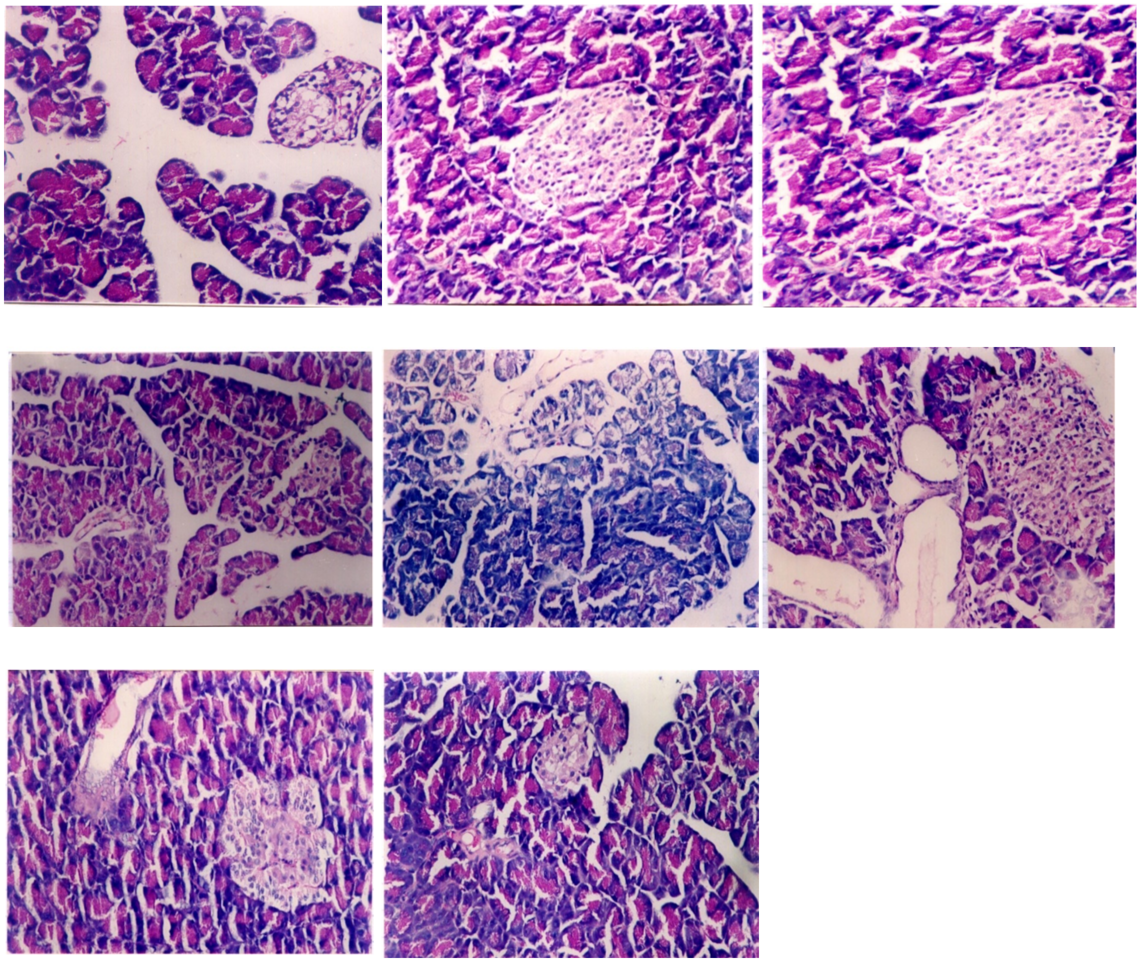

Figure (1): Effect of tested leaves on histopathological changes of pancreases of diabetic rats. (From a to h) a, Pancreas of rat from group 1 showing no histopathological changes (H and E X 200). (control diet); b,c,d,e,f,g,h fed on diet containing turnip leaves and roots and their mixture 2.5 and 5 % for 28 day after induced by alloxan (H&E, X 200).

Conclusion

The leaves and roots of the plant selected in this study were effective in protecting mice from hyperglycemia. These results supported our hypothesis that the tested leaves of the plant contained several important compounds such as fiber, minerals, polyphenols, flavonoids, and carotenoids capable of inhibiting the process of hyperglycemia.

Therefore, the data recommended the leaves and roots of the plant (turnip) selected in a moderate amount to be included in our daily diets.

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التأثير المحتمل لأوراق وجذور اللفت علي الفئران المصابة بالسكر بتأثير الألوكسان

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الملخص العربى

أجريت هذه الدراسة لتقييم التأثيرات المضادة لارتفاع السكر في الدم لأوراق وجذور اللفت على الفئران التي تعاني من ارتفاع سكر الدم. حيث تم استخدام اثنان وثلاثون من ذكور الفئران البيضاء البالغة وزن كل منها 150-160 جرامًا بحيث وتم تقسيمها إلى مجموعتين رئيسيتين ، المجموعة الأولي تحتوي 4 فئران تم الاحتفاظ بها كمجموعة ضابطة سالبة والمجموعة الثانية (28 فأر) تم حقنها بالألوكسان بمعدل 150جم/كجم من وزن الجسم لأصابتها بالسكرواعادة تقسيمها الي المجموعات التالية, مجموعة كنترول موجبة والمجموعات الأخري التي تم تغذيتها علي نظام غذائي لمدة 28 يوم. حيث تم إعطاء مسحوق أوراق وجذور نبات اللفت ومخلوطهما بنسبة 5 .2 و 5 ٪ من الوجبة الأساسية لمدة 28 يومًا. في نهاية التجربة ، تم تقديرجلوكوز الدم , والكوليسترول ، والدهون الثلاثية (TG) ، والليبوبروتينات عالية الكثافة عالي الكثافة (HDL-c) ، و ALT ، و AST ، و ALP ، واليوريا ، والكرياتينين ، وحمض اليوريك. أشارت نتائج الدراسة التي تم الحصول عليها إلى أن جذور وأوراق اللفت ($P\leq0.05$) أدت إلى انخفاض نسبة الجلوكوزو VLDL في الدم وزيادة HDL كما أن جذور وأوراق اللفت حسنت وظائف الكبد والكلى وتمنع بعض التغيرات النسيجية المرضية في البنكرياس. فرضية النتائج التي تم الحصول عليها والتي تم اختبار أجزاء من النبات تحتوي على عدة مركبات قادرة على تحسين الآثار الضارة وخفض نسبة السكر في الدم . لذا فإن البيانات الموصى بها استخدام هذه النباتات بكميات معتدلة في وجباتنا الغذائية.

الكلمات المفتاحية: جلوكوز الدم، HDL-c ، وظائف الكبد والكلى ، الفئران المصابة بارتفاع الجلوكوز ، فحص الأنسجة.