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# Potential Therapeutic Applications of Persimmon (*Diospyros kaki-Virginiana*) fruits and leaves as Evaluated on diabetic Male Albino Rats

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## Abstract:

This study aims to study the effects of Persimmon *(Diospyros kaki-Virginiana)* fruits and leaves on biological and biochemical parameters of diabetic rats. Forty male mature albino rats weighing 140-150g per each, were randomly divided into two main groups .Group I: negative control (-ve) fed on standard diet . Group Π: diabetic rats n=35 (treated by alloxan 150 mg\kg Bwt. to induce diabetic) , then divided into equal seven subgroups the first : group was kept as control (+ve) , while the left six groups were given daily fruits and leaves of *Persimmon (Diospyros kaki-Virginiana)* powder at 2.5% , 5% and 7.5% for 28 days. At the end of the experiment, Body weight gain (BWG), Feed intake (F.I), Feed Efficiency Ration(FER), glucose , Serum asparatate aminotransferase (AST) ,Total protein, serum albumin, Globulin, Serum alanine aminotransferase (ALT) , Alkaline phosphatase (ALP) , urea, creatinin, uric acid were determined . The results of the obtained data showed that BWG , FI and FER were markedly non significant in all tested groups as compared to control (+ve) group. Also, data indicated that the effect of persimmon leaves was higher than the effect of persimmon fruit on blood glucose and feeding on 7.5% persimmon leaves had the highest effect. Incase of total protein all diabetic rats fed on different diets showed significant increases in mean values as compared to control (+) group. The best treatment considering the serum total protein (T.P) was recorded for group"8" (7.5%

persimmon leaves ) in comparison with *control* (-) group. Also, serum albumin increased rats which fed on groups 4, 6 and 8 (diabetic rats fed on 2.5% persimmon leaves , 5% persimmon leaves and 7.5% persimmon leaves , respectively ) showed nonsignificant differences between them and there were non significant as compared to control (-) group. So, the best results of ALB were recorded in these groups . beside that , all diabetic rats fed on various diets revealed a significant decreases in mean values as compared to control (+) group for serum globulin mean . while, improved liver and kidney functions. So, from this study results concluded that intake of fruits and leaves powder of persimmon fruit especially at 7.5% can be useful for improving diabetic .

**Key words**: T.P, ALB , GLB , liver and kidney function, Diabetic (DM).

## Introduction

Diabetes mellitus (DM) is a chronic progressive metabolic disorder characterized by hyperglycemia mainly due to absolute (Type 1 DM) or relative (Type 2 DM) deficiency of insulin hormone ( **Saurabh *et al*., 2013**) and is expected to increase to 439 million by 2030 **(Chen *et al*., 2011)**.

Diabetes complications are common among patients with type 1 or type 2 diabetes but, at the same time, are responsible for significant morbidity and mortality. The chronic complications of diabetes are broadly divided into microvascular and macrovascular, with the former having much higher prevalence than the latter. Microvascular complications include neuropathy, nephropathy, and retinopathy, while macrovascular complications consist of cardiovascular disease, stroke, and peripheral artery disease (PAD). Diabetic foot syndrome has been defined as the presence of foot ulcer associated with neuropathy, PAD, and infection **(Konstantinos *et al*., 2018).**

Drug therapies often lose their effectiveness with time and natural compounds are gaining attention for curing diabetes mellitus and allied complications .In Asian communities, natural products are more popular to cure type 2 diabetes mellitus. However, these drugs often accompany escalating side effects. In response, natural foods are replacing these **(Masood *et al*., 2015)**. Phytochemicals, such as polyphenolic compounds, carotenoids, ascorbate and vitamin E received much

attention, mainly due to their antioxidant activity and the relevant role they would play in prevention and treatment of several human diseases **( Zhang and Tsao, 2016)**.

Persimmon fruits (*Diospyros kaki*) are rich in antioxidants such as ascorbic acid, carotenoids and various polyphenols, including tannins **( Favati *et al*., 2018 and Maulidiani *et al*., 2018)**.

Recently , great attention has been paid to a number of nonvitamin antioxidants, widely distributed in natural sources like fruit, vegetables, and spices, having the ability to enhance the antioxidative defense mechanism at cellular level without side effects.. The main group of compounds that act primarily as free radical terminator or antioxidants is plant phenolics. Among fruits, persimmon is comprised of a large number of biologically active polyphenols like tannins and flavonoids having good antioxidant potential. These polyphenols prevent the diabetes resulting from oxidative stress .since these work as antioxidants preventing the peroxidation of lipids by the donation of a hydrogen atom from hydroxyl group attached to their chemical structure rapidly and form peroxyl radical (ROO) that ultimately leads to the formation of alkyl (aryl) hydroperoxide (ROOH) **(Shazia *et al*., 2016)**.

**Masood *et al*., (2015)** estimated that inhibition of pancreas alpha-amylase could be one of major mechanisms responsible for the antidiabetic role of persimmon However, the antidiabetic effects are dependent on degree of polymerization of bioactive components of persimmon .

Recently, it has been shown that persimmon possesses several pharmacological activities such as strong radical scavenging and antioxidant properties and antigenotoxic and anticarcinogenic and anti-inflammatory and antihypertensive and antidiabetic effects **(Jang *et al*., 2010)**.

Therefore, further studies are required to elucidate whether persimmon and their leaves may be effective for the prevention and treatment of diabetes. So the present study aims to determine the effect of Persimmon *(Diospyros kaki-Virginiana)* fruit and leaves on diabetic rats.

**Materials And Methods**

**Source Of Material :**

Persimmon fruits (*Diospyros kaki- Virginiana)* were purchased from the local market in shebin El-kom, Egypt. And leaves were obtained from Ministry of Agriculture Farm .All chemicals and diagnostic kits were purchased from El-Gomhoria Co., Cairo, Egypt.

**Preparation of the tested material:**

Whole ripening fruits were washed, sliced into 1cm thick rings and then were dehydrated at 50°C in a cabinet dryer for 12 hr and powdered **(Akyidiz *et al*., 2004)**. and leaves were dried at 40 ºC for three days and ground into fine powder by using electric grinder. Persimmon powder and leaves mixed with the basal diet before the rats were fed.

**Rats and diet :** Male albino rats, weighting 140-150 g ±10gwhich obtained from Research Institute Ophthamology Medical Analysis Department ,Cario.

**Alloxan and basal diet constituents :** were obtained from El-Gomhoria Company for trady Drug Chemicals and Medicals, Cairo, Egypt.

**Chemicals:** The basal diet was prepared according to the following : protein (14%), soybean oil (4%), vitamin mixture (1%),salt mixture (3.5%), cellulose (5%), choline chloride(0.2%), methionine (0.3%) and the remained is corn starch up to 100 according to **AIN, (1993**).

**Experimental Design:**

Forty male albino rats were housed in healthy condition (21-23ºC) and fed on basal diet for one week before starting the experiment for acclimatization . After this, rats were divided into two main groups, Group I (5rats) fed on basal diet as a negative control (-ve) , Group Π (35 rats) diabetic rats injected by alloxan ( 150 mg/ kg then classified into seven equal sub groups as follow:

**Sub group (1):** Diabetic rats feed on basal diet as apositive control.

**Sub group (2):** Diabetic rats treated with 2.5% persimmon kaki fruits powder .

**Sub group (3):** Diabetic rats treated with 2.5% persimmon leaves powder.

**Sub group (4**): Diabetic rats treated with 5% persimmon kaki fruits powder.

**Sub group (5):** Diabetic rats treated with 5% persimmon leaves powder .

**Sub group (6):** Diabetic rats treated with 7.5% persimmon kaki fruits powder.

**Sub group (7):** Diabetic rats treated with 7.5% persimmon leaves powder During the experiment period, the feed intake and body weight were weigthed daily and twice a week, respectively. Body weight gain (BWG) and Feed efficiency ratio (FER) were calculated at the end of the experimental period according to the following equations:

**BWG (g) = final weight (g) - initial weight (g)**

**FER = weight gain (g) / feed intake (g/day/rat)**

At the end of the experimental period, rats were sacrificed after a12 hr. fast. then scarified .Blood samples were centrifuged for 20 min at 3000 rpm to separate the serum samples which were kept in tube at -20° C till biochemical analysis according to **Drury and Wallington, (1980).**

**Biochemical analysis:**

Blood glucose was carried out calorimetrically according to the method of **Tinder , (1969).**Serum total protein, serum albumin and serum globulin were determined as g/dl according to the method described by **Weissman *et al*., (1950)** and **Doumas *et al*.,( 1971)** modified by **Spencer and Price, (1977)** and **Chary and Sharma, (2004)** respectively **.** Serum asparatate aminotransferase (AST), serum alanine aminotransferase (ALT) and alkaline phosphatase (ALP) were carried out according to the method of **Henry *et al*., (1974), and IFFC,(1983).**Urea, creatinine and uric acid were determined according to the methods of **Patton and Crouch ,(1977) ; Henry, (1974),** and **Schultz, (1984**), respectively.

**Statistical analysis:** Results are expressed as mean values with their standard deviation of the mean. In order to compare the groups Analysis of Variance (ANOVA) test was used. Values at $P \leq 0.05$ were considered to be statistically significant according to **SAS, (2006).**

**Results and Discussion**

From table (1) ,data showed the effect of Persimmon *(Diospyros kaki-Virginiana)* fruits and leaves on feed intake (FI), body weight gain (BWG), and feed efficiency ratio (FER) in diabetic rats . For body weight gain , the mean value of BWG of control (+) group was lower than control (-) group, being 0.84 ± 0.01(g) and 2.7±0.05 respectively, showing significant difference between them . All diabetic rats fed on various diets showed significant increases in mean values as compared to control (+) group. there is no significant differences among groups ( 4

and 5) also, there is no significant differences among the groups (7 and 8).The best BWG was recorded for groups 6 and 8 ( diabetic rats fed on 5% leaves and 7.5% persimmon fruit). Concerning feed intake , data revealed that the mean value of ( F.I) of control (+) group was lower than control (-) group, being 5.9 ± 0.12 and 7.04 ± 0.05 (g) respectively, showing a significant difference. The percent of increasing +19.3 % of control (-) as compared to control (+) . G4, G6 and G7 showed nonsignificant differences in mean values which were 6.18 ± 0.07,6.1 ±015 and 6.2± 0.1 (g/day/rat), respectively as compared to control (+).Also, there is no significant between groups (3 and 8) being 6.5 ±0.1 and 6.6 ±0.1, respectively. Numerically the best F.I was recorded for group 3 and 8 (diabetic rats fed 2.5% persimmon fruit and 7.5% persimmon leaves respectively) when compared to control (-) group. For FER, data showed that the mean value of FER of control (+) group was lower than control (-) group, being 0.14 ±0.01 and 0.38 ±0.2 respectively, showing a significant difference with percent of increase+ 171.4% of control (-) group as compared to control (+). Groups (4, 5, 6, 7 and 8) showed a significant increases in mean values as compared to control (+) group . Groups 6, 7 and 8 showed nonsignificant differences between them. Groups 4 and 5 showed nonsignificant differences between them .Also there is nonsignificant differences between group 3 (diabetic rats fed on 2.5% persimmon fruits) and positive control group. Numerically , the best FER was recorded for group 6 (diabetic rats fed on 5% persimmon leaves) when compared to control (-) group.

These results disagree with the finding carried out by **Gorinstein *et al*.,( 2000)** they estimated that addition of persimmon to the diets did not affect diet intake, its efficiency or body weight gains of rats.

**Table (1): Effect of Persimmon *(Diospyros kaki-Virginiana)* fruit and leaves on feed intake (FI), body weight gain (BWG), and feed efficiency ratio (FER) in diabetic rats.**

| Rat Serial | Groups | BWG (g) | FI (g/day/ rat) | FER(g/day) |
|---|---|---|---|---|
| **1** | **control (-ve)** | $2.7\pm0.05^{a}$ | $7.04\pm0.05^{a}$ | $0.38\pm 0.02^{a}$ |
| **2** | **control (+ve)** | $0.84\pm0.01^{f}$ | $5.9\pm0.12^{c}$ | $0.14 \pm0.01^{d}$ |
| **3** | **2.5% fruit powder** | $0.98\pm0.01^{e}$ | $6.5\pm0.1^{b}$ | $0.15\pm0.01^{d}$ |
| **4** | **2.5%leaves powder** | $1.1\pm0.1^{d}$ | $6.18\pm0.07^{c}$ | $0.18\pm0.002^{c}$ |
| **5** | **5% fruit powder** | $1.06\pm0.03^{d}$ | $5.7\pm0.2^{d}$ | $0.185\pm0.01^{c}$ |
| **6** | **5% leaves powder** | $1.6\pm0.04^{b}$ | $6.1\pm0.15^{c}$ | $0.26 \pm0.01^{b}$ |
| **7** | **7.5% fruit powder** | $1.45\pm0.05^{c}$ | $6.2\pm0.02^{c}$ | $0.23 \pm0.03^{b}$ |
| **8** | **7.5% leaves powder** | $1.48\pm0.07^{c}$ | $6.6\pm0.1^{b}$ | $0.23\pm0.001^{b}$ |
| | **LSD** | 0.075 | 0.2 | 0.027 |

Values are mean ± SD. Values in the same column sharing the same superscript letters are not statistically significantly different.

**Effect of Persimmon *(Diospyros kaki-Virginiana)* fruits and leaves on serum glucose (mg/dl) in diabetic rats**

The effect of persimmon fruit and leaves on glucose of diabetic rats was tabulated in table (2) It could be noticed that the mean value of glucose of control (+) group was higher than control (-) group , it was being 222.3±2.5, 98±1 (mg/dl) respectively, showing significant difference with percent of decrease – 55.9 of control (-) group as compared to control (+). All diabetic rats fed on different diets indicate significant decreases in mean values as compared to control (+) group. The effect of persimmon leaves was higher than the effect of persimmon fruit on blood glucose and feeding on 7.5% persimmon leaves had the highest effect which was 99.6±3.0 (mg/dl). Persimmon leaves significantly suppressed the increase in the post-prandial blood glucose levels as compared to those in PBS-treated mice. Insulin has a pivotal role in maintaining the post-prandial glucose levels within a normal range by enhancing glycogen synthesis and glycolysis, and by suppressing gluconeogenesis **( Bouché *et al*.,2004).**Persimmon peel ( PP) containing high levels of dietary fiber and antioxidants with antidiabetic properties represents a potential dietary supplement for improving hyperglycemia and diabetic complications **(Syng-Ook *et al*.,2006).**Another study in Wistar albino diabetic rats also suggested persimmon is rendered a hypoglycemic effect from its antioxidant defense mechanisms **(Dewanjee *et al*., 2009). Gao *et al*., (2009**) reported that the protection of total flavonoids from persimmon leaf possesses significant hypoglycemic activities. Similar results have been reported by a study of five-week treatment with powdered persimmon leaves **(Jung *et al*., 2012**), who suggested that long-term oral supplementation with persimmon leaf can effectively exert glycemic control in diabetic mice. In addition, five-day oral supplementation with PLE prevented diabetes development in STZ-treated mice. In recent meta-analysis studies, flavonoids have been reported to have acute and chronic effects on glucose and lipid metabolism **(Van Dam *et al*., 2013 and Liu *et al*.,2014).** The results of table (2) are agreement with that obtained by ( **UI-Jin *et al*., 2015)** they suggested that Persimmon Leaves Extract (PLE) was shown to improve the biochemical

parameters of glucose and lipid metabolism and prevented fatty liver development in mice after eight weeks of oral supplementation .

**Table (2): Effect of Persimmon *(Diospyros kaki-Virginiana)* fruit and leaves on glucose (mg/dl) in diabetic rats.**

| | Groups | Glucose (mg/dl) | LSD |
|---|---|---|---|
| **1** | **control (-ve)** | $98\pm1^{g}$ | 2.57 |
| **2** | **control (+ve)** | $222.3\pm2.5^{a}$ | |
| **3** | **2.5% fruit powder** | $126\pm0.5^{b}$ | |
| **4** | **2.5%leaves powder** | $119\pm0.29^{c}$ | |
| **5** | **5% fruit powder** | $108\pm0.39^{d}$ | |
| **6** | **5%leaves powder** | $101.8\pm0.76^{f}$ | |
| **7** | **7.5% fruit powder** | $1o4.9\pm0.72^{e}$ | |
| **8** | **7.5%leaves powder** | $99.6\pm3.05^{f}$ | |

Values are mean ± SD. Values in the same column sharing the same superscript letters are not statistically significantly different.

**Effect of Persimmon *(Diospyros kaki-Virginiana)* fruits and leaves on Total protein (T.P), Serum albumin (ALB) and Globulin (GLB) in diabetic rats**

Data of table (3), showed the mean value of serum T.P, Serum albumin (ALB) and Globulin (GLB**)** of diabetic rats fed on various diets. It could be observed that the mean value of T.P. of control (+) group was lower than control (-) group, being 8.08±0.01 and 9.58±0.01 (g\dl) respectively, indicating a significant difference with percent of increase +17.5% of control (-) group when compared to control (+) group. All diabetic rats fed on different diets showed a significant increases in mean values as compared to control (+) group. Groups 3, 4 and 5 showed nonsignificant differences between them. Nonsignificant differences recorded also between groups 7 and 8. The best treatment considering serum T.P was recorded for group"8" (7.5% persimmon leaves*)* in comparison with control (-) group. For serum albumin, it could be observed that the mean value of (ALB) of control (+) group was lower than control (-) group, being 1.88 ±0.01 and 2.06±0.05 (g\dl) respectively, showing a significant difference, with percent of increase +9.57% of control (-) group as compared to control (+)group. Groups 3,5 and 7 (diabetic rats fed on 2.5%persimmon fruit ,5% persimmon fruit ,7.5% persimmon fruit respectively, showing a

significant increase of mean values as compared to control (+) group. Groups 4, 6 and 8 showed nonsignificant differences between them and there were non-significant as compared to control (-) group so, the best results of ALB were recorded in these groups . Also, differences between groups 3 and 7 were not significant. Concerning Globulin, it could be observed that the mean value of Globulin of control (+) group was higher than control (-) group, being 7.47±0.02 and 6.01±0.01 (g/dl) respectively, indicating a significant difference with percent of decrease -19.5% of control (-) group when compared to control (+)group. All diabetic rats fed on various diets revealed significant decreases in mean values as compared to control (+) group. Groups (6 and 7) showed nonsignificant differences between them. Numerically, the best treatment was observed for group 8 (7.5% persimmon leaves) when compared to control (-) group.

**Table (3): Effect of Persimmon *(Diospyros kaki-Virginiana)* fruits and leaves on Total protein (T.P), Serum albumin (ALB) and Globulin (GLB) in diabetic rats.**

| Rat Serial | Groups | T.P(g\dl) | ALB(g\dl) | GLB(g\dl) |
|---|---|---|---|---|
| **1** | **control (-ve)** | $9.58\pm0.01^{a}$ | $2.06\pm0.05^{a}$ | $6.01\pm 0.01^{g}$ |
| **2** | **control (+ve)** | $8.08\pm0.01^{e}$ | $1.88\pm0.01^{d}$ | $7.47 \pm0.02^{a}$ |
| **3** | **2.5%fruit powder** | $8.8\pm0.09^{d}$ | $1.96\pm0.01^{c}$ | $6.76\pm0.06^{c}$ |
| **4** | **2.5%leaves powder** | $8.82\pm0.02^{d}$ | $2.07\pm0.02^{a}$ | $6.87\pm0.012^{b}$ |
| **5** | **5%fruit powder** | $8.78\pm0.01^{d}$ | $2.01\pm0.01^{b}$ | $6.71\pm0.01^{d}$ |
| **6** | **5%leaves powder** | $8.93\pm0.03^{c}$ | $2.06\pm0.02^{a}$ | $6.54\pm0.01^{e}$ |
| **7** | **7.5%fruit powder** | $9.03\pm0.04^{b}$ | $1.96\pm0.02^{c}$ | $6.51\pm0.03^{e}$ |
| **8** | **7.5%leaves powder** | $9.06\pm0.06^{b}$ | $2.04\pm0.01^{a}$ | $6.28\pm0.03^{f}$ |
| | **LSD** | 0.084 | 0.025 | 0.04 |

Values are mean ± SD. Values in the same column sharing the same superscript letters are not statistically significantly different.

**Effect of *Persimmon (Diospyros kaki-Virginiana)* fruit and leaves on AST ,ALT and ALP parameters (U/L) in diabetic rats**

Data of table (4) illustrated the mean value of serum AST , ALT and ALP of diabetic rats fed on various diets. For AST, it could be noticed that the mean value of (AST) of control (+) group was higher

than control (-) group, being 294.2±1.75 and 206.1±0.96 (U/L) respectively, showing significant difference with percent of decrease -29.94 % of control (-) group when compared to control (+) group. All diabetic rats fed on different diets revealed significant decreases in mean values as compared to control (+) group. Groups 4 and 5 showed nonsignificant differences between them. The best treatment was observed for group 8 (7.5% persimmon leaves*)* when compared to control (-) group considering (AST) activity. For ALT, it could be observed that the mean value of (AST) of control (+) group was higher than control (-) group, being 99.43±0.66 and 58.6±0.17 (U/L) respectively, showing significant difference with percent of decrease -41.06% of control (-) group when compared to control (+) group. All diabetic rats fed on various diets revealed significant decreases in mean values as compared to control (+) group. The best treatment was observed for group *8* (7.5% persimmon leaves) in comparison with group healthy rats. In case of ALP, It could be noticed that the mean value of (ALP) of control (+) group was higher than control (-) group, being 299.3 ±2.5 and 116 ±1(U/L) respectively, indicated a significant difference with percent of decrease -61.24 % of control (-) group when compared to control (+)group. All diabetic rats fed on various diets revealed a significant decreases in mean values as compared to control (+) group. Numerically, the group of 7.5% persimmon leaves recorded the better treatment of serum ALP.These results agree with **Jia *et al*., (2007)** they showed that the persimmon leaf methanol extract and persimmon fruit methanol extract treatments decreased the activities of serum alanin aminortasferase (ALT) and aspartate aminotransfase (AST) compared with ethanol control. **El-Hawary *et al*.,(2019)** showed that this plant can provide a good nutritional value and it is safe regarding the kidney and liver functions, good source that help in enhancing the antioxidant defense against free radicals. No abnormal effects were found in lipids profile on experimental animals and there were good results in the ratio of HDL and LDL cholesterol. Also, this plant can help in optimizing blood sugar, enhancing the level of blood haemoglobin. It is concluded that *D. kaki* displays a good source of nutrients and bioactive compounds that may contribute to its therapeutic benefits against the risk of disease complications.

**Table (4): Effect of *Persimmon (Diospyros kaki-Virginiana)* fruit and leaves on AST ,ALT and ALP parameters (mg/dl) in diabetic rats.**

| | Groups | AST(U\L) | ALT(U\L) | ALP(U\L) |
|---|---|---|---|---|
| 1 | control (-ve) | 206.1±0.96 $^{g}$ | 58.6±0.17$^{h}$ | 116± 1$^{h}$ |
| 2 | control (+ve) | 294.2±1.75$^{a}$ | 99.43±0.66$^{a}$ | 299.3±2.5$^{a}$ |
| 3 | 2.5% fruit powder | 251±2$^{b}$ | 85.57 ±0.4 4$^{b}$ | 224±2$^{b}$ |
| 4 | 2.5%leaves powder | 248±1$^{c}$ | 81.97±0.54$^{c}$ | 220.5±1.1$^{c}$ |
| 5 | 5% fruit powder | 246±0.5 $^{c}$ | 77.02±0.37$^{d}$ | 207.2±1.5$^{d}$ |
| 6 | 5%leaves powder | 235.07±0.88 $^{e}$ | 68.56±0.23$^{f}$ | 165.3±1.5$^{e}$ |
| 7 | 7.5% fruit powder | 237.9±0.6 $^{d}$ | 73.5±0.5$^{e}$ | 151.1±1.03$^{f}$ |
| 8 | 7.5%leaves powder | 230.1±1.15$^{f}$ | 60.30±0.19$^{g}$ | 141.2±1.05$^{g}$ |
| | LSD | 2.18 | 2.46 | 0.75 |

Values are mean ± SD. Values in the same column sharing the same superscript letters are not statistically significantly different.

**Effect of Persimmon *(Diospyros kaki-Virginiana)* fruits and leaves on Urea , Uric acid and Creatinin parameters (mg/dl) in diabetic rats**

Data in table (5) indicated that illustrate the mean value of serum urea (mg/dl) of diabetic rats fed on various diets. It could be noticed that the mean value of urea of control (+) group was higher than control (-) group, being 48.2 ± 0.72 and 22.8 ±0.76 mg/dl respectively, indicating a significant difference with percent of decrease -52.6 % of control (-) group when compared to control (+) group. All diabetic rats fed on different diets revealed a significant decreases in mean values as compared to control (+) group. Groups 3 and 4 showed nonsignificant differences between them. Also groups 5, 6 and 7 indicated nonsignificant differences between them. Numerically the best treatment was recorded for group 8 (7.5% persimmon leaves) when compared to control (-) group of serum urea. For uric acid , It could be observed that the mean value of uric acid of control (+) group was higher than control (-) group, being 4.17±0.02 and 2.07±0.01 (mg/dl ) respectively, indicating significant difference with percent of decrease -50.3% of control (-) group when compared to control (+)group. All

diabetic rats fed on various diets revealed significant decreases in mean values as compared to control (+) group. Groups(4 and 5) showed nonsignificant differences between them. Numerically the best treatment was observed for group 7 and 8 (7.5% persimmon fruit and 7.5%persimmon leaves*)* when compared to control (-) group. It seems possible that persimmon kaki fruit and its leaves could correct the changes in kidneys function due to injection of rats with alloxan. Also, It could be observed that the mean value of creatinine of control (+) group was higher than control (-) group, being.88±0.12 and 0.57 ±0.081 respectively, showing a significant difference with percent of decrease -29.60% of control (-) group when compared to control (+) group. All diabetic rats fed on different diets revealed a significant decreases in mean values as compared to control (+) group. Besides that, there were no significant differences (P>0.05) in serum Creatinin between groups 6,7(diabetic rats fed on 5% persimmon leaves ,7.5% persimmon kaki fruit ). Numerically the best treatment was recorded for group 8 (7.5% persimmon leaves) when compared to control (-) group. These results were in agreement with **Sunity and Himanshu , (2011)**, they showed that supplementation of the diet with powered persimmon leaf(5%, w/w) for 5 weeks not only decreased the concentration of blood urea nitrogen in the plasma but also improved glomerular hypertrophy. Furthermore, the persimmon leaf significantly decreased the levels of hydrogen peroxide and lipid peroxide in the kidney. The activities of superoxide dismutase, catalase, and glutathione peroxidase and the mRNA expression of their respective genes were also increased in the kidney of persimmon leaf-supplemented mice. Taken together, these results suggest that supplementation with the persimmon leaf may have protective effects against type 2 diabetes-induced kidney dysfunction and oxidative stress.

**Table (5): Effect of Persimmon *(Diospyros kaki-Virginiana)* fruit and leaves on Urea , Uric acid and Creatinin parameters (mg/dl) in diabetic rats.**

| | Groups | Urea(mg/dl) | Uric acid (mg/dl) | Creatinin(mg/dl) |
|---|---|---|---|---|
| 1 | control (-ve) | 22.8±0.76$^{e}$ | 2.07±0.01$^{g}$ | 0.57± 1$^{f}$ |
| 2 | control (+ve) | 48.2±0.72$^{a}$ | 4.17±0.02$^{a}$ | 0.88±2.5$^{a}$ |
| 3 | 2.5%fruit powder | 38.5±0.5$^{b}$ | 2.84 ±0.04$^{b}$ | 0.78±2$^{b}$ |
| 4 | 2.5%leaves powder | 35.2±0.2 $^{bc}$ | 2.72±0.02$^{c}$ | 0.74±1.1$^{c}$ |
| 5 | 5% fruit powder | 33.4±0.4 $^{c}$ | 2.69 ±0.02$^{c}$ | 0.67±1.5$^{d}$ |
| 6 | 5%leaves powder | 32.5±5.22$^{c}$ | 2.59 ±0.01$^{d}$ | 0.65±1.5$^{e}$ |
| 7 | 7.5% fruit powder | 31.04±0.28$^{c}$ | 2.45±0.02$^{e}$ | 0.63±1.03$^{e}$ |
| 8 | 7.5%leaves powder | 27±0.22$^{d}$ | 2.15±0.02$^{f}$ | 0.58±1.05$^{f}$ |
| | LSD | 3.38 | 0.048 | 0.023 |

Values are mean ± SD. Values in the same column sharing the same superscript letters are not statistically significantly different.

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المؤتمر الدولى السابع- العربى الحادى والعشرون للإقتصاد المنزلى
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# التأثيرات البيولوجيةِ المحتملة لثمار الكاكى وأوراقها عند التقييم على ذكور الفئران المصابة بالسكرى

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**الملخص العربي**

تم إجراء الدراسة الحالية لمعرفة تأثير ثمار وأوراق فاكهه الكاكى على الفئران المصابة بالسكرى. لذلك تم إستخدام ٤٠ فأر ألبينو بالغ متوسط وزنها ( ١٤٠- ١٥٠) جم والعمر (٣ أشهر). تم تغذيتها على الوجبة الأساسية لمدة أسبوع ثم قسمت الى مجموعتين رئيستين , المجموعة الأولى : مجموعة ضابطة سالبه ( ٥ فئران ), المجموعة الثانية : الفئران المصابة بالسكرى ٣٥ فأر (تم حقنهم بمقدار ١٥٠ مجم/ كجم من وزن الجسم بمادة الألوكسان بهدف اصابة الفئران بمرض السكر), تم تقسيمها الى سبعة مجموعات فرعية متساوية :

مجموعة١ تتغذى على الوجبة الأساسية طوال فترة التجربة لمجموعة ضابطة موجبة أما باقى المجموعات التى تم معالجتها باضافة مسحوق أوراق وثمار الكاكا بنسب ٢,٥% , ٥% , ٧,٥% على التوالى طول فترة التجربة.

ثم استمرت التجربة ٢٨ يوم وفى نهاية التجربة تم وزن الفئران ثم ذبحهم وتجميع عينات الدم بعد صيام ١٢ ساعة ، حساب كلا من(الوزن المكتسب , المأخوذ الغذائى , معدل كفاءة الغذاء ) والجلوكوز والبروتين الكلى والألبيومين والجلوبيولين وتم قياس انزيمات الكبد (ALT- AST-ALP) ووظائف الكلى(اليوريا- الكرياتين – حمض اليوريك).وقد أظهرت نتائج هذه الدراسة أن تناول ثمار وأوراق الكاكى نتج عنه, وانخفاض مستوى جلوكوز الدم في حالة البروتين الكلي ، سجلت جميع المجموعات المدعمة بالغذاء التجريبي ارتفاعا معنويا في البروتين الكلى عند مستوى($p\leq0.05$) عند مقارنتها بالمجموعة الضابطة الموجبة وكانت مجموعة ٨ (٧.٥ ٪ ثمار أوراق الكاكى ) أفضل المجموعات من الناحية الغذائية.وقد أوضحت النتائج المتحصل عليها أن هناك فروقا غير معنوية بين المجموعات ٤و٦و٨ (الفئران المصابة بالسكر التي تغذت على ٢.٥٪ من أوراق و ثمار الكاكى، وأوراق ثمار الكاكى بنسبة ٥٪ وأوراق ثمار الكاكى بنسبة ٧.٥٪ على التوالي) مقارنة بالمجموعة الضابطة السالبة ,وأفضل المعاملات سجلت للمجموعات المشار اليها سابقا ,وعلى الجانب الأخر سجلت النتائج انخفاض معنويا فى الجلوبيولين مقارنة مع المجموعة الضابطة الموجبه .وأدت المجموعات المعالجة الى تحسن وظائف الكبد والكلى.

**الكلمات المفتاحية:** البروتين الكلى – الألبيومين – الجلوبيولين – وظائف الكلى والكبد- مرض السكرى .