

Antioxidant and hypoglycemic activity of doum fruit (*hyphaene thebaica*. L) extracts on diabetic albino rats

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Abstract

Doum fruits (*Hyphaene thebaica*. L) were extracted with boiling water and ethanol: water (80: 20 v/v) respectively, phenolic, flavonoids compound and antioxidant activity were determined as well as analyzed by HPLC. Total phenolic, total flavonoids and antioxidant activity content of ethanolic doum extracts were higher than aqueous doum extracts. Ethanolic doum extracts were rich in phenolic compounds; The highest quantities were Oleuropein (45.41 mg/g), Coumarin (25.17 mg/g), Catechin (19.55 mg/g), Ferulic (14.21 mg/g) and Salicylic (10.05 mg/g). In addition to presence five flavonoid compounds were Rosmarinic acid (40.12 mg/g), Hesperidin (28.35 mg/g), Quercitrin (19.02 mg/g), Myrecetin (12.44 mg/g) and Apigenin (8.12 mg/g). Forty rats were divided into 5 groups, where one (negative control). Rats' injection one single alloxan then treated with either 10 mg/kg glibenclamide, 200 mg/kg ethanolic doum extracts and 200 mg/kg aqueous doum extracts and compared to negative and positive control. Treatment diabetic rats with ethanolic doum extracts significantly reduced the levels of serum glucose and glycated hemoglobin to be within the levels of the negative control, while aqueous doum extracts produced similar but less effective actions. Animals treated with either ethanolic doum extracts or aqueous doum extracts showed reduced levels of liver and kidney markers compared to the negative control. Both ethanolic and aqueous doum extracts could better correct the changes in lipid profiles induced by alloxan injury.

Keywords: Doum fruit extracts; Diabetes mellitus, serum glucose, glycated hemoglobin, liver and kidney markers.

Introduction

Diabetes mellitus (DM) is a condition in which blood sugar levels are unusually high due to a malfunction in insulin synthesis, which causes difficulties in a variety of body systems and contributes considerably to cardiovascular morbidity and mortality. (El-Hadary & Ramadan, 2019). Diabetes complications include blindness, strokes, kidney failure, and heart failure. Diabetes is treated with oral antidiabetic or antihyperglycemic medications. Glibenclamide, often known as glyburide, is a sulfonylureas molecule with a chemical name of glibenclamide. Drugs are more expensive and have a variety of adverse effects, including changes in liver and kidney function as well as changes in hematological characteristics (El-Hadary & Sitohy, 2021). Glibenclamide, at doses of 10 mg per day, was found to lower blood glucose levels in long-term research (Rambiritch, et al., 2014)

Type 1 diabetes (insulin-dependent), Type 2 diabetes (non-insulin-dependent) (NIDDM), and gestational diabetes (which occurs when a woman is pregnant) are the three basic kinds of diabetes. Type 2, is a metabolic condition characterized by low insulin production and/or insulin resistance in peripheral and hepatic tissues. Type 2 diabetes mellitus is known to account for 90-95 percent of all diabetes cases (Inzucchi and Sherwin, 2005).

Hyphaene thebaica (Family Arecaceae) is a palm tree with a woody feel and edible oval fruits that is native

to Upper Egypt. Doum palm fiber and leaflets, which are used to weave baskets, and doum nuts, which contain antioxidants and secondary metabolites such as tannins, phenols, saponin, steroids, glycosides, flavonoid, terpenes, and terpenoids, are all beneficial elements of the doum palm. Doum is a traditional Egyptian beverage that is high in polyphenolic chemicals and is commonly consumed. Also utilized in medicine, ropes, and baskets are roots, stems, and leaves (Shuaibu et al., 2012).

Also, (Shuaibu et al., 2012) discovered that *Hyphaene thebaica* dry herbs have been utilized in Uyghur folk medicine for centuries to treat heart disease, blood pressure, angina, neuralgia, migraine, and toothache.

3-OH tyrosol, E-vanillic acid, catechin, and chlorogenic acid had the greatest phenolic component concentrations in doum fruit aqueous extracts, while alpha-coumaric acid, cinnamic acid, p-coumaric acid, and coumarin had the lowest (Hetta and Yassin, 2006). The flavone glycosides luteolin 7-O- β -glucuronide, apigenin 7-O- β -glucuronide, luteolin O- β -glycoside, luteolin 7-O-rutinoside, and chrysoeriol 7-O-rutinoside were extracted and identified from doum fruits (Amany 1994).

The current study intends to compare and contrast the possible anti-diabetic effects of doum fruits extracts on alloxan-induced diabetic albino rats with glibenclamide as a control. The prospective consequence is most likely a low-cost, easy, and safe method of reducing the spread of type-2 diabetes by using well-defined natural materials.

Material and methods

1. Materials

The doum (*H. thebaica*) was purchased from the Qena desert area in southern Egypt, in Summer (2017) and was crushed in the lab to ensure quality. All reagents and standards were purchased from SIGMA-ALDRICH Co. (Louis, Missouri, USA). Diagnostic kits i.e. Lipid profile, liver and kidney function were purchased from Bio Meriêux Laboratory Reagents and Products, France.

2. Methods

2.1. Preparation of doum palm fruit extract:

The doum fruits were cleaned, residues were removed, and the pulp and seeds were separated. After drying at 70°C, the pulp was ground into a fine powder. Boil 250 grams of pulp powder in a liter and a half of distilled water for two hours on a magnetic stirrer to make doum fruit extract. Then was soaked for seven days in a 1:5 ratio of 80% ethanol to water (80:20 v/v) at room temperature (25-30°C) in a dark environment, mixing gently every 2 days. The mixture was filtered through a Buchner funnel filter paper using a suction pump, condensed using a rotary evaporator at 40°C, and then was freeze-dried. According to the protocol, these crystals were weighed, dissolved in distilled water, and given orally to the experimental animal for the treatment of diabetes mellitus (Victor *et al.*, 2015).

2.2. Determination of total phenolic and total flavonoid compounds (TPC)

Phenolics were determined according to (Bobinait *et al.*, 2012). Phenolics were expressed as gallic acid equivalent. Flavonoids were determined using aluminum chloride colorimetric method (Meda *et al.*, 2005). Flavonoid contents were expressed as quercetin equivalents.

2.3. Determination of antioxidant activity (DPPH• radical scavenging activity)

Ethanollic and aqueous extracts were assayed by 2, 2-diphenylpicrylhydrazyl (DPPH•) antiradical test according to the Blois (2002)

2.4. HPLC analyses

Analysis of ethanollic doum extracts was performed by HPLC system (Agilent 1100) is composed of two LC- pumps, a UV/Vis detector. C₁₈ column (125 mm × 4.60 mm, 5 µm particle size). Chromatograms were obtained and analyzed using the Agilent ChemStation. (Kuntic *et al.*, 2007).

2.5. Experimental animals

This experiment was performed to investigate the effect of ethanollic and aqueous doum fruit extract on albino rats. This study was conducted with biochemical parameters of the blood. A total of 40 mature male albino rats (Wister Strain) weighing 127 to 152g were collected from the Giza Agricultural Research Center's farm. They were housed in a stainless

steel cage with a wire floor and kept at a constant temperature of 25±2°C. Rats were fed a baseline diet for 14 days while being kept in a typical healthy state. Free access to water and a standard diet was allowed (Reeves, *et al.*, 1993).

2.5.1. Experimental design

After a two-week acclimation period, forty rats were separated into five groups, each with eight rats (Abdel-Hamid *et al.*, 2020). The first group (Normal negative control) was fed a basal meal and given a 0.9 percent injection of normal saline. The other four groups were given a single intraperitoneal injection of alloxan monohydrate dissolved in normal saline (100 mg/kg body weight) (0.9 percent saline) (Ighodaro, *et al.*, 2017) and were confirmed diabetic by having blood glucose more than 250 mg/dL after 48 h of injection. The first group received no further treatment and functioned as a diabetic positive control group. The three remaining groups were given the following treatments in aqueous solutions via gastric oral gavages for 56 days: 10 mg/kg glibenclamide (Group III), 200 mg/kg ethanollic doum extract (Group IV), and 200 mg/kg aqueous doum extract (Group V).

2.5.2. Blood analysis

Blood samples were taken from the retro-orbital plexus veins using fine capillary heparinized tubes and divided into three tubes at the end of the experiment. In the first tube glucose concentration was determined according to (Trinder, 1969). The second tube was used to place a blood sample into an Ethylenediaminetetraacetic acid (EDTA) solution in order to assess the amount of glycated hemoglobin in the blood (HbA1c) according to (Nayak & Pattabiraman, 1981). The whole blood was allowed to coagulate in the third tube, and the serum was separated by centrifugation at 3000 rpm for 15 minutes to calculate the serum lipid profile, which included total lipids (TL), triglycerides (TG), total cholesterol (TC), and high density lipoprotein cholesterol (HDL-C) according to Fossati & Precipe (1982); Finely, (1978); Naito & Kaplan (1984). Low density lipoprotein cholesterol (LDL-C) levels were calculated according to the equation: LDL-C=TC-(HDL+VLDL-C), where VLDL-C was calculated as TG/5 (Friedewalds *et al.*, 1972).

Alanine transaminase (ALT), aspartate transaminase (AST), alkaline phosphatase (ALP), and total bilirubin were measured in the liver. according to (Reitman & Frankel, 1957; Tietz, 1983). Kidney function parameters, i.e.; urea, uric acid and creatinine were assessed according to (Tabacco *et al.*, 1979).

2.6. Statistical analysis

Statistical analysis was carried out using ANOVA with one factor under significance level of 0.05 for the whole results using SPSS var.19 and data were treated as complete randomization design according to (Steel *et al.*, 1997). Multiple comparisons were carried out applying LSD.

Results and discussion

1. Bioactive constituents

Total phenolic content of doum (*Hyphaene thebaica*) ethanolic and aqueous extracts were 124.67 ± 0.09 and 111.20 ± 0.04 mg/GAE extract, respectively, while total flavonoids of doum (*Hyphaene thebaica*) ethanolic and aqueous extracts are 44.69 ± 0.05 and 41.37 ± 0.12 mg/QE extract, as shown in Table 1. The determine values of total phenolic compounds, total flavonoids, and antioxidant activity in ethanolic doum extracts were higher than in

aqueous doum extracts. Data presented in table (1) shows antioxidant activity of doum (*Hyphaene thebaica*) ethanolic and aqueous extracts in both DPPH equalled 48.33% and 45.0% respectively. These findings are in line with previously published findings by **Eldahshan, et al., (2008)**. Previous research has shown that scavenging the radical 1,1-diphenyl-2-picrylhydrazyl was used to test the antioxidant activity (DPPH) as described by **Tadolini et al., (2000)**.

Table 1. Total phenolic, total flavonoid and antioxidant activities of ethanolic and aqueous extracts for doum fruits (*Hyphaene thebaica*):

parameters	Ethanolic extract	Aqueous extract
Total phenolic mg GAE/ g extract	124.67 ± 0.09	44.69 ± 0.05
Total flavonoids mg QE/ g extract	111.20 ± 0.04	41.37 ± 0.12
Antioxidant activity (%)	48.33 ± 7.80	45.0 ± 15.87

3.2. Identification of some antioxidant components in doum (*Hyphaene thebaica*) ethanolic extract by HPLC:-

The results in figure (1) reveal the presence of five phenolic compounds in doum ethanolic extract. The highest quantities were Oleuropein (45.41 mg/g), Coumarin (25.17 mg/g), Catechin (19.55 mg/g), Ferulic (14.21 mg/g) and Salicylic (10.05

mg/g). However, data in figure (2) shows the presence of five flavonoids compound in doum ethanolic extract. The highest quantities were Rosmarinic acid (40.12 mg/g), Hesperidin (28.35 mg/g), Quercitrin (19.02 mg/g), Myrecetin (12.44 mg/g) and Apigenin (8.12 mg/g). These results are good in agreement with those reported by **Eldahshan, et al., (2008)**.

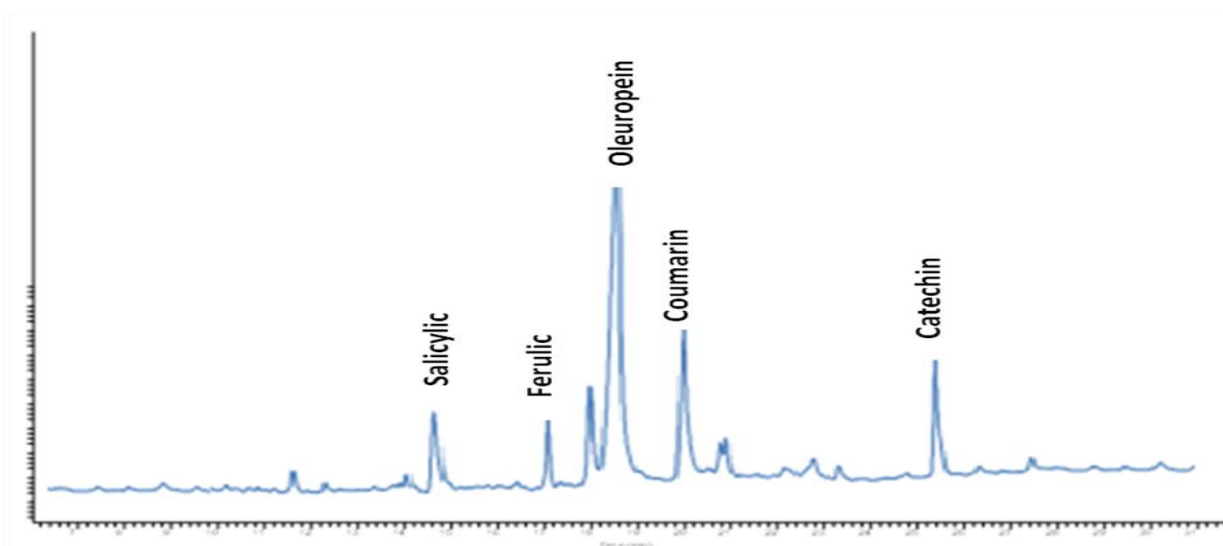


Figure (1): Phenolic compounds of doum (*Hyphaene thebaica*) ethanolic extracts analyzed by HPLC

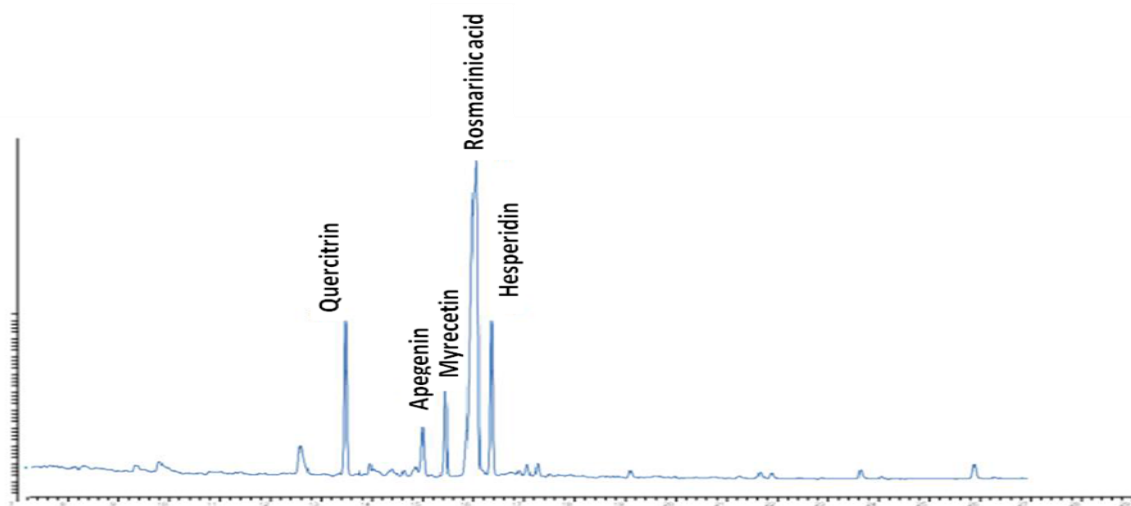


Figure (2): Flavonoids compounds of *doum* (*Hyphaene thebaica*) ethanolic extracts analyzed by HPLC

3. Effects of doum (*Hyphaene thebaica*) ethanolic and aqueous extracts on HBA1c and blood glucose in diabetic rats

The results in Table 2 show that positive control animals had significantly higher levels of blood glucose and glycated hemoglobin, more than three times of normal values (negative control). The levels of these two parameters were dramatically decreased in rats treated with ethanolic and aqueous doum fruit extracts, with the ethanolic -treated rats' levels falling within the negative control range, but the aqueous -

treated rats' levels remaining higher than the negative control.

The considerable reduction in blood glucose and HbA1c levels caused by doum extracts is consistent with earlier mentioned results **Abd el Halim, 2020** when compared with the control positive group. Oral administration of ethanolic and aqueous doum (*Hyphaene thebaica*) extracts at different doses increased blood sugar levels and decreased serum glucose levels. The presence of bioactive components e.g. polyphenols, flavonoids, saponine and terpenoids may be responsible for this activity.

Table 2. Effects of doum (*Hyphaene thebaica*) ethanolic and aqueous extracts on HBA1c and blood glucose in diabetic rats

Groups	Treatment	Glucose (mg/dL)	HbA1c (g/100g)
1	Negative control	116.4 ^e ± 1.03	5.18 ^e ± 0.09
2	Positive control (diabetic)	382.4 ^a ± 0.87	14.08 ^a ± 0.04
3	Diabetic rats and received orally Glibenclamid 10mg/kg	132.4 ^d ± 0.87	6.08 ^d ± 0.04
4	Diabetic rats and received orally doum ethanolic extract 200 mg/kg	145.2 ^c ± 1.24	6.50 ^c ± 0.04
5	Diabetic rats and received orally doum aqueous extract 200 mg/kg	157.4 ^b ± 0.68	6.98 ^b ± 0.02

Note. Values with same letter(s) have no significant difference

3.4. Effects of ethanolic and aqueous extracts of doum (*Hyphaene thebaica*) on diabetic rat liver markers

The obtained results cited in Table 3 indicate that the enzyme activities in serum of the negative control group were found to be (87.40±0.98, 48.10±1.06, and 104.5±1.04 U/L) after 8 weeks for AST, ALT and ALP, respectively. While in the case of positive control diabetic rats without any treatment the mean values of these parameters were increased to 142.7±0.99, 61.21±0.57 and 163.3±0.92 U/L. The positive control rats had considerably higher levels of

AST, ALT, and ALP, as a result of liver function indicators.

On the basis of the foregoing findings, it can be inferred that the activities of AST, ALT, and ALP in the serum of alloxan-diabetic rats were considerably higher than in the control group. The activity of the enzymes AST, ALT, and ALP increments in response to changes in the metabolism in which they are engaged. Increased activity of transaminase, which is more active in the absence of insulin, may enhance the availability of amino acids in diabetes mellitus

patients' blood, as well as gluconogenesis and ketogenesis (Bayad, 2016).

The oral administration of ethanolic and aqueous extracts of doum (*Hyphaene thebaica*) extracts in dose (200 mg/kg) indicated that diabetic rats had significantly decrement in these enzymes (AST, ALT and ALP) compared with rats of positive

control. These mean values were found to be 95.31; 95.89 U/L for AST, 66.3; 64.16 U/L for ALT and 117.1; 125.4 U/L for ALP at different levels respectively. This reduction may be due to the major bioactive compounds in *Hyphaene thebaica* e.g. polyphenol and flavonoids which act as antioxidant compounds Kamis *et al.*, (2003).

Table 3. Effects of ethanolic and aqueous doum (*Hyphaene thebaica*) extracts on diabetic rat liver markers:-

Groups	Treatment	ALT (U/L)	AST (U/L)	ALP (U/L)
1	Negative control	48.10 ^d ± 1.06	87.40 ^d ± 0.98	104.5 ^e ± 1.04
2	Positive control (diabetic)	83.75 ^a ± 0.79	142.7 ^a ± 0.99	163.3 ^b ± 0.92
3	Diabetic rats received orally Glibenclamid 10mg/kg	61.21 ^c ± 0.57	91.46 ^c ± 0.60	182.1 ^a ± 0.96
4	Diabetic rats received orally Doum ethanolic extract 200 mg/kg	66.30 ^b ± 0.78	95.31 ^b ± 0.86	117.1 ^d ± 1.02
5	Diabetic rats received orally doum aqueous extract 200 mg/kg	64.16 ^{bc} ± 0.66	95.89 ^b ± 0.92	125.4 ^c ± 2.43

Note. Values with same letter(s) have no significant difference

3.5 Effects of ethanolic and aqueous doum (*Hyphaene thebaica*) extracts on diabetic rat renal function markers:-

Alloxan causes diabetic hyperglycemia, which increases serum levels of urea, uric acid, and creatinine, all of which are important indicators of renal failure. (Kattias *et al.*, 2011).

It can be observed in Table 4 that alloxan augmented the levels of renal function parameters urea; uric acid and creatinine (61.73±0.37, 4.45±0.06 and 5.11±0.27 mg/dL) respectively when compare with healthy control rats (45.27± 0.45, 3.38±0.03 and 1.29±0.02 mg/dL). However, oral administrations of doum ethanolic and aqueous extracts at (200 mg/kg B.W) led to decrements levels of urea, uric acid and creatinine if compared with diabetic rats, while these parameters were non-significant differentiation

compared with control negative rats. The mean values of urea were found to be 50.38±0.88 and 54.57±0.68 mg/dL, 3.89± 0.01 and 3.92±0.04 mg/dL for uric acid while these values were 0.70±0.02 and 0.73±0.01 mg/dL for creatinine at different doses respectively.

The obtained data showed that doum (*Hyphaene thebaica*) extract decreased renal function parameters i.e. urea, uric acid and creatinine levels in diabetic rats.

Alloxan's damaging effects on renal function are mostly owing to its effects on the glomerular filtration rate (GFR) and the production of oxidative stress. (El-Hadary & Sitohy, 2021). Both ethanolic and aqueous doum extracts improved renal function by inhibiting ROS and increasing the generation of vasoactive mediators. These results are in agreement with those reported by Victor *et al.*, (2015).

Table 4. Effects of ethanolic and aqueous doum (*Hyphaene thebaica*) extracts on diabetic rat renal function markers:

Group	Treatment	Urea (mg/dL)	Creatinine (mg/dL)	Uric acid (mg/dL)
1	Negative control	45.27 ^d ± 0.45	1.29 ^b ± 0.02	3.38 ^c ± 0.03
2	Positive control (diabetic)	61.73 ^a ± 0.37	5.11 ^a ± 0.27	4.45 ^a ± 0.06
3	Diabetic rats received orally Glibenclamid (10mg/kg)	45.40 ^d ± 0.74	1.45 ^b ± 0.01	3.77 ^b ± 0.03
4	Diabetic rats received orally doum ethanol extract 200 mg/kg	50.38 ^c ± 0.88	0.70 ^c ± 0.02	3.89 ^b ± 0.01
5	Diabetic rats received orally doum aqueous extract 200 mg/kg	54.57 ^b ± 0.68	0.73 ^c ± 0.01	3.92 ^b ± 0.04

Note. Values with same letter(s) have no significant difference

3.6. Effect of doum (*Hyphaene thebaica*) ethanolic and aqueous extracts on diabetic rats' lipid profile (total lipid, triglycerides, total cholesterol, HDL-cholesterol, and LDL-cholesterol):

Data in Table (5) indicate that diabetic rats had the highest values of total lipid, triglycerides, total cholesterol, and LDL-cholesterol. These mean values were (586.6±1.83, 56.88±0.29, 186.2±0.66 and 137.4±0.98 mg/dL) respectively while rats fed basal

diet without any treatment (negative control) had the lowest of total lipids, triglycerides, total cholesterol, LDL cholesterol which were found to be (462.5±1.21, 36.50±0.27, 152.6±1.04, 90.49±0.76 mg/dL) respectively and had the highest value of HDL cholesterol 54.80±0.37 mg/dL comparing with diabetic rats 37.42±0.48 mg/dL.

Because insulin inhibits hormone sensitive lipase, the unusual elevation in lipid profile concentrations in diabetics are mostly owing to increased immobility of free fatty acids from peripheral fat depots. Acute insulin deprivation produces an increment in free fatty acid mobilization from adipose tissue due to insulin's inhibitory impact on HMG-COA reductase, a crucial rate-limiting enzyme responsible for the breakdown of cholesterol rich LDL-C particles.

Oral administration of doum ethanolic and aqueous extracts (200 mg/kg) led to significant reductions in total lipids, total cholesterol,

triglycerides, and LDL-cholesterol, particularly at 200 mg/kg. The obtained results shows that, oral administration of *doum* ethanolic extract at 200mg/kg reduced total cholesterol from 186.2±0.66 to 135.2±2.27 mg/dL while at 200mg/kg *doum* aqueous extract reduced total cholesterol from 186.2±0.66 to 148.3±0.47 mg/dL, triglyceride from 56.88±0.29 mg.dL⁻¹ to 39.37±0.37 and 48.31±0.60 mg/dL, LDL-cholesterol from 137.4±0.98 mg/dL to 82.86±2.07 and 96.05±0.72 mg/dL. On the other hand increased HDL, compared to the positive control. The accomplished results are in agreement with those reported by **Abd el Halim (2015) and Bayad,(2016)**.

Both ethanolic and aqueous doum extracts have remedial properties which maybe and can be attributed to decreasing the fat absorption and increasing the fat excretion, the obtained results agree with previous reports mentioned by **Abd el Halim (2015) and Bayad, (2016)**.

Table 5. Effect of doum (*Hyphaene thebaica*) ethanolic and aqueous extracts on diabetic rats' lipid profile.

Group	Treatment	T lipids (md/dL)	Total cholesterol (mg/dL)	HDL Cholesterol (mg/dL)	Triglyceride (mg/dL)	LDL Cholesterol (mg/dL)	VLDL (mg/dL)
1	Negative control	462.5 ^{b±} 1.21	152.6 ^{b±} 1.04	54.80 ^{a±} 0.37	36.50 ^{d±} 0.27	90.49 ^{c±} 0.76	7.30 ^{d±} 0.05
2	Positive control (diabetic)	586.6 ^{a±} 1.83	186.2 ^{a±} 0.66	37.42 ^{e±} 0.48	56.88 ^{a±} 0.29	137.4 ^{a±} 0.98	11.38 ^{a±} 0.06
3	Diabetic rats received orally Glibenclamid 10mg/kg	405.9 ^{d±} 1.34	135.5 ^{c±} 1.09	46.78 ^{b±} 0.17	33.39 ^{e±} 0.28	33.21 ^{c±} 0.97	6.68 ^{c±} 0.06
4	Diabetic rats received orally doum ethanolic extract 200 mg/kg	403.8 ^{d±} 2.06	135.2 ^{c±} 2.27	44.46 ^{c±} 0.53	39.37 ^{c±} 0.37	82.86 ^{d±} 2.07	7.87 ^{c±} 0.07
5	Diabetic rats received orally doum aqueous extract 200 mg/kg	415.5 ^{c±} 1.33	148.3 ^{b±} 0.47	42.59 ^{d±} 0.32	48.31 ^{b±} 0.60	96.05 ^{b±} 0.72	9.66 ^{b±} 0.12

Note. Values with same letter(s) have no significant difference

Conclusion

Ethanolic and aqueous doum (*Hyphaene thebaica*) extracts may be useful in the treatment of diabetes, with no negative effects on the liver, kidneys, or lipid profile. As evidenced by the bio-oxidant state of the treated animals. This action appears to be dependent on the antioxidant activity of the bio-constituents of both extracts (saponins, phenolics, and flavonoids).

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النشاط المضاد للأكسدة وخفض السكر في الدم للجرذان المصابة بداء السكري لمستخلصات فاكهة الدوم

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قسم الكيمياء الحيوية الزراعية - كلية الزراعة - جامعة بنها

تم استخلاص ثمار الدوم (*Hyphaene thebaica*. L) بالماء المغلي والإيثانول: الماء (80:20 حجمية / حجمية) على التوالي ، وتم تقدير محتوى المركبات الفينولية و الفلافونيدات والنشاط المضاد للأكسدة وكذلك تحليلها بواسطة جهاز التحليل الكروماتوجرافي السائل. فكان إجمالي محتوى الفينولات والفلافونويدات الكلية ومحتوى النشاط المضاد للأكسدة للمستخلص الإيثانولي للدوم أعلى من المستخلص المائي للدوم. المستخلص الإيثانولي للدوم كان غنياً بالمركبات الفينولية. كانت أعلى القيم هي (أوليوروبين 45.41 مجم / جم) ، (الكيومارين 25.17 مجم / جم) ، (كاتشين 19.55 مجم / جم) ، (حمض الفوريك 14.21 مجم / جم) ، (الساليسيليك 10.05 مجم / جم). بالإضافة الي الفلافونويدات وكانت أعلى القيم هي (حمض الروزمارينك 40.12 مجم / جم) ، (الهسبردين 28.35 مجم / جم) ، (الكيورستين 19.02 مجم / جم) ، (الميرستين 12.44 مجم / جم) و (الابجنين 8.12 مجم / جم). تم إجراء تجربة بيولوجية لدراسة استخدام مستخلصات فاكهة الدوم لخفض السكر في الدم للجرذان المصابة بداء السكري. تم استخدام أربعون جرذ مقسمة إلى 5 مجموعات حيث مجموعة واحدة (الكنترول السالبة بدون معاملات). والباقي تم حقنهم بالأوكسان ثم عولجت إما بـ 10 مجم . كجم جليبيكلاميد ، 200 مجم. كجم ، المستخلص الإيثانولي للدوم 200 ملجم / كجم المستخلص المائي للدوم ومقارنة بالكنترول السالبة والموجبة. أدى علاج الفئران المصابة بداء السكري بمستخلص الدوم الإيثانولي إلى خفض مستويات الجلوكوز في الدم والهيموجلوبين إلى حد كبير لتكون ضمن مستويات الكنترول السالبة ، بينما نتائج مستخلص الدوم المائي كانت أقل فعالية. أظهرت الحيوانات المعالجة بمستخلص الدوم الإيثانولي أو مستخلص الدوم المائي انخفاضاً في نشاط أنزيمات الكبد والكلية مقارنة بالكنترول الموجبة. أوضحت النتائج أن كل من مستخلصات الدوم الإيثانولي والمائي أدت الي تصحيح التغييرات في بروفيل الدهون الناتجة عن إصابة الأوكسان. من النتائج المتحصل عليها يمكن الاستنتاج أن المستخلصات المائية والإيثانولية لثمار الدوم مفيدة كمستخلصات طبيعية في المساهمة في علاج المصابون بداء السكري ولكن نحتاج الي مزيد من التجارب الحيوية.