The Egyptian Journal of Hospital Medicine Vol., 10 : 90 – 108 March 2003
I.S.S.N: 12084
1687 -2002

Anti – diabetic properties of water and ethanolic extracts of Balanites aegyptiaca fruits flesh in senile diabetic rats.

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Abstract

The present study was designed to evaluate the role of a medicinal plant for management of diabetes instead of manufactured drugs, which led to many complications. Medicinal plants would be highly useful for this purpose because they are considered to be effective and non-toxic and safer than manufactured drugs.

Water and ethanolic extracts of Hegleg (*Balanites aegyptiaca*) fruits were investigated for their hypoglycemic and hypolipidimic effect in normal senile diabetic rats in addition to some hormones related to diabetes mellitus. It has been recently known that leptin and insulin are involved in the regulation of energy balance and body weight in addition to reduction of blood glucose level.

The extract induced significant reduction in serum glucose, glucagon, total lipids, total cholesterol, triglycerides level and transaminases (AST, ALT and γGT) activities. Liver glycogen, serum insulin, leptin and testoeterone concentrations significantly increased in treated animals compared to control. The present data revealed insignificant changes in the serum total protein, albumin and globulin level during the experimental period. The obtained data suggest the beneficial role of *Balanites aegyptiaca* fruit as a hypoglycemic, hypolipidimic agent and as a protective a gent of liver from damage or injury. These results suggest that the anti-diabetic effect of *Balanites aegyptiaca* fruit flesh my be attributed at least in part to increased glucose metabolism and produces an increase in serum insulin concentration.

Introduction

At least 90 million people throu - ghout the world suffer from *diabetes mellitus* (Swanston-Flatt *et al* 1991).

Lowering the concentration of glucose in blood is the best defense against the late complications and negative outcomes of *diabetes mellitus* such as blindness, renal failure and limb amputation (Will and Byer, 1996). Although insulin therapy is the primary treatment for lowering blood glucose, the first approach to *diabetes mellitus* treatment generally involves increasing physical activity, reducing weight and improving the diet (Fertig *et al*., 1995 and Marles 1995).

Medicinal plants have been also used to prevent and control the complications associated with diabetes mellitus. Insulin and the other drugs which are used to control diabetes are chemical compounds that may result in many complications. On the other hand, the medicinal plants are supposedly

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safe, effective and better oral ypoglycemic agents. (Lotliker and Rajarama Rao, 1996).

Medicinal plants have been used for centuries by diabetic patients in India, Eraq, Unani, Russia, Emrrates, Egypt and many other countries. They are considered to be effective and non-toxic (Puri *et al*., 1994, Bhat, 1997).

More than 400 traditional plant treatments for *diabetes mellitus* have been recorded. onion (*Allium cepa*) (Swanston-Flatt *et al*., 1991) and garlic, *Allium sativum* (Rawi *et al*.1996). They have long been used as dietary supplement for the traditional treatment of diabetes in Asia, Europe and Middle East (Day 1984). The seeds of *Trigonella foenum graecum* are more widely recommended for non-independent *diabetes mellitus* patients. (Ajabnoor and Tilmisany, 1988 and Shani *et al*., 1994). The essential oil of *Nigella sativa* was reported to exhibit hypoglycemic effect. (Abdel-Salam *et al*., 1992 and Al-Hader *et al*., 1993). *Artemisia herba alba* and *cuminum nigrum* seeds are also widely used in Egyptian folk medicine for the treatment of *diabetes mellitus* (Akhtar and Ali, 1985, Al-Shamanaony *et al*.1994, Houghton 1995 and Subramo - niam *et al*., 1996). Zizyphus is, one of the plants commonly used in Egyptian folk medicine has been reported for the treatment of diabetes (Glombitza, *et al*. 1994).

The leaves of *Mongifera* indica are also used as an antidiabetic agent in Nigerian folk medicine (Aderibigbe *et al*., 1999). Oral administration of the ethanolic extract of rhizome of *Nelumbo nucifera* markedly reduced the blood sugar level of normal, glucose-fed hyperglycemic and streptozotocin indu - ced diabetic rats, when compared with control animals (Mukherjee *et al*., 1997). The extract of *Azadirachta indica*, *Gymnema sylvestre*, *catharan* - *thus roseus* and *Ocimum sanctum* was found to decrease the blood sugar level in varying degrees (Chattopadhyay, 1999). Oral administration of 2.5 and 5g/kg body weight of the aqueous extract of the *Syzigium cumini* known as jamun is widely used in Indian folk medicine by diabetic patients (Prince *et al*., 1998). In normal rats, both the aqeuous and 50% ethanolic extracts of *Caesalpinia Bonducella* fleming seeds were reported to have and diabetic activity (Sharma *et al*., 1997). The same results were observed by Amed *el al*. 1998 when they examined the effect of Monordica charantia fruit juice on islet of pancreas of diabetic rats.

A single oral administration of the water extract of *Eqisetum myrioc* - *haetum* arial parts at doses of 7 and 13 mg/kg and of the butanol extract at doses of 8 and 16 mg/kg from on streptozotocin-diabetic rats (Andrade Cetto *et al*., 2000). Oral administration of aqueous: ethanolic (50% v/v) extract of *Punica granatum* flowers led to significant blood glucose lowering effect in normal, glucose-fed hypergl - ycemic and alloxan-induced diabetic rats (Jafri *et al*., 2000).

Oral administration of the ethanolic extracts of *Luffa aegyptiaca* (seeds) and *Carissa edulis* (leaves) on blood glucose levels both in normal and streptozotocin diabetic rats led to significant decrease of blood glucose level (El-Fiky *et al*. 1996). Oral admi - nistration of oil of *Eruca sativa* seeds led to hypoglycemic, lypolipidimic and lowering of the concentration of hypotriglyceridimic and total hypo-cholesterolimic (El-Missiry and El-Gindy, 2000). An alcoholic extract of *Picrorrhiza kurroa* was found to lower blood glucose in basal conditions and after a heavy glucose load in normal rats. (Joy and Kuttan, 1999). Aqueous

extract of *Morus alba* leaves was reported as hypoglycemic as well as hypolepidimic agent (Kim *et al*., 1999 and El-Eraky and Yassin, 2001). *Balanites aegyptiaca*, a data like fruits called hegleg data is known in folk medicine for its hypoglycemic effect.

Ten percent *Smallantus sonch - ifolius* (yacon) decoctio produced a significant decrease in plasma glucose levels in normal and streptozotocin induced diabetic rats when administered by intraperitoneal injection or gastric tube (Ayber *et al*., 2001).

Intraperitoneal administration of some medicinal plants significantly diminished the hyperglycemia in mildly diabetic mice (Alarcon- Aguilar *et al*., 2002).Medicinal plants in India have shown varying degree of hypoglycemic and anti- hyperglycemic activity (Grover *et al*.,2002).

Treatment of the diabetic rats with the aquueous suspention of some herbal plants (*Lupinus albus, Lupinus termis, Halfa barr and Zygophyllum coccineum) restored the activities of* the AST,ALT,ALP and LDH to their normal level in plasma,liver and tetes in alloxan induced diabetic rats (Mansour *et al.*, 2002).

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Medicinal plants act as a tonic for the islets of pancreas making it naturally secrete insulin. Some medicinal plants contain an insulin-like substance prod - uced by the pancreas. The medicinal plants make the body cells more sen - sitive to insulin naturally. The medicinal plants control the release of glucose form the liver (Grover *et al*.,2002).

Treatment of the diabetic rats with the aquueous suspention of some herbal plants (*Lupinus albus, Lupinus termis, Halfa barr and Zygophyllum coccineum) restored the activities of* the AST,ALT,ALP and LDH to their normal level in plasma,liver and tetes in alloxan induced diabetic rats (Mansour *et al.*, 2002). Insulin resistance may link disorders of metabolic homeostasis suchas diabetes and obesity with disorders of hemodynamic homeostasis (Chen *et al.,2003)*

The present work was therefore planned to study the effects of both aqueous and ethanolic extracts of *Balanites aegyptiaca* on serum glucose level, and on glycogen content of liver and on serum glucagon, leptin and testosterone levels of hyperglyc senile rats. It was also aimed to find out the changes in liver function parameters.

Material and Methods

Materials:

1. ***Animals***: Male senile diabetic albino rats (*Rattus norvigicus*) weighing about (250 - 300 g) were obtained from the laboratory Unit of Egyptian Organization for Biological and Vaccine production. Dokki, Egypt. All rats were examined for diabetic or non and the diabetic ones (10 rats) were selected for glucose tolerance curve, also the same number were used for young rats. They were acclimatized to laboratory conditions with a 12 hours light for a period of 10 days before the experiment. Animals were

fed *ad libitum* with standard laboratory diet composed of soybean (15%) corn (50%), cotton seed oil (15%), meat powder (5%), limestone (1%), vitamins (1%), sodium chloride (3%) and cellulose (10%). They were allowed free excess to water.

2. ***Blood glucose tolerance curve:*** Oral glucose tolerance test (OGTT) was performed on normal senile diabetic and young rats (120-150g). Blood samples were obtained from retro-orbital plexus of overnight fasted rats (10-12 hours). Successive blood samples were then taken at 30, 60, 90, 120 and 150 minutes following the administration of glucose solution (1g/kg. b.wt) via gastric intubation. Rats with serum glucose level ranging from (200-300 mg/100ml) blood were used, as indicated in figure (1).
3. ***Preparation of fruit flesh:*** *Balanites aegyptiaca*: *Balanites aegyptiaca* fruit flesh can be obtained from palm trees that grow in desert of the southern valley of Egypt (Halaeib and Shelateen area). *Balanites aegyptiaca* has a wide ecological distribution and it belongs to family Balanitiaceae and is also known as Hegleg or Balah El-Abeed. The date is dark brown in colour; and the fleshy pulp of both unripe and ripe fruits is edible and eaten dried or fresh. Fruit flesh were sliced and weighed and the seeds were discarded. The flesh portions were dried at 110°C for one hour, then the temperature was decreased to 70°C for 48 hrs.
4. ***Extraction of the fruit flesh:*** Fruit flesh was extracted either with water or with absolute ethanol, in a soxhlet apparatus for 10 hours according to the Association of Offecial Analytical Chemists (AOAC, 1970) procedure.
5. ***Design of the experiment:*** The animals were administered *Balanites aegyptiaca* extracts by stomach tube and they were divided into three groups with equal number of animals (10 rats/group) according to the following scheme:

   Control (senile diabetic male albino rats) fed control diet and drinking water supplemented with 0.2 ml ethanol/rat for 30 days.

   Second group of rats were drenched 2 ml/rat daily of aqueous extract of *Balanites aegyptiaca* (80 mg/kg b.wt), 100 gm. dissolved in 10 ml water for 30 days.

   Third group of rats received a daily dose of 2 ml/rat of ethanolic extract of *Balanites aegyptiaca* (80 mg/kg b.wt), 100 gm. dissolved in 10 ml ethanol for 30 days.
6. ***Blood sampling and handling:*** Blood samples were collected using capillary tubes from retro-orbital plexus of rats (Schermer, 1967) into clean centrifuge tube. The blood samples were allowed to coagulate and centrifuged at 4000 rpm for 20 minutes to separate blood serum. Separated serum was stored at -20°C for subsequent biochemical analyses.
7. *Liver glycogen*: Liver samples were removed immediately after decapi - tation of the rats, cooled and homogenized in saline solution for evaluation of liver glycogen content.

Methods:

Serum glucose level was estimated enzymatically according to the method of Trinder (1969). The glycogen content of the liver was determined by an throne method as described by Carrol *et al*., (1955). Serum insulin was measured by radio immunoassay (Reeves 1983) in Gamma Trade Company. Serum glucagon was

determined by using the method of Nishino (1981). Serum leptin levels were estimated with a recently described radio immunoassay (Ahren *et al*., 1997b). Serum testosterone level was measured according the method of Hill *et al*., (1985). Serum total lipids level was determined using the method of Knight *et al*., (1972). Serum total cholesterol level was estimated according to Sidle *et al*., (1983) method. Serum triglycerides level was measured using Van Handle and Zilversmit (1957). Serum total protein concent - ration was estimated according the method of Doumas (1975). Serum albumin level was measured according to the method of Doumas et al., (1971). Serum globulin was calculated by subtracting albumin form total protein. Serum alanine amionotransferase (ALT) and aspartate amino transferase (AST) activities were measured according to the method of Reitman and Frankel (1957). Serum γGT was estimated using the method of Szassz (1969).

Statistical analysis

The obtained data were statistically analyzed using student's "t" test (Snedecor and Cochran 1971). Results were expressed as mean $\pm$ standard error (S.E) and values of $P \leq 0.05$ were considered statistically insignificant, while values of $P \leq 0.05$ were considered statistically insignificant.

Results

Oral administration of aqueous extract from *Balanites aegyptiaca* fruit flesh for 30 days to normal senile diabetic rats induced a highly signify - cant decrease ($P \leq 0.01$) of serum glucose level compared to control group (normal senile diabetic rats non treated with the extract) as indicated in table (1) and figure (2). Drenching ethanolic extract for the same period exerted a highly significant decrease ($P \leq 0.01$) in blood glucose level compared to that of the control as shown in table (1) and figure (2).

Concerning liver glycogen content, there was highly significant increased ($P \leq 0.01$) due to oral administration of either aqueous or ethanolic extract of *Balanites aegyptiaca* fruit flesh compared to control as shown in table (1) and figure (3).

Oral administration of aqueous extract of *Balanites aegyptiaca* fruit flesh to normal senile diabetic rats for 30 days induced significant increase ($P \leq 0.05$) of serum insulin level. Also a highly significant increase ($P \leq 0.01$) of serum insulin level was observed after 30 days of oral administration with ethanolic extract as in indicated in table (1) and figure (4) in comparison to control.

The serum glucagon hormone level of normal senile diabetic rats treated with either aqueous or ethanolic extracts revealed highly significant decrease ($P \leq 0.01$) compared to normal senile diabetic rats (control), as indicated in table (1) and figure (5).

Results revealed that administration of aqueous extract from *Balanites aegy - ptiaca* fruits induced a significant increase ($P \leq 0.05$) in leptin hormone level. The ethanolic extract induced a higher significant value ($P \leq 0.01$) after 30 days compared to the normal senile diabetic rats as indicated in table (1) and figure (6)]. As shown in table (1) and figure (7) aqueous or ethanolic extract of *Balanites aegyptiaca* fruit flesh given to normal senile diabetic rats significantly raised serum testosterone level ($P \leq 0.01$).

Normal senile diabetic rats treated with aqueous extract from *Balanites aegyptiaca* fruit induced a significant decrease ($P \leq 0.01$) in serum total lipids, total cholesterol and triglyceride level after 30 days compared to those

corresponding values of control or normal senile diabetic rats. Similar decreases in serum total lipids, total cholesterol and triglycerides were also observed in normal senile rats treated with ethanolic extract of *Balanites aegyptiaca* fruit as illustrated in table (2) and figures (8, 9 and 10).

Aqueous or ethanolic extract of *Balanites aegyptiaca* fruit flesh induced in significant change of serum total protein, albumin and globulin of senile diabetic rats after 30 days of treatment compared to that corresponding control value as illustrated in figures (11, 12 and 13).

Table (2) and figures (14, 15 and 16) illustrate that the activities of transaminases (ALT and AST) are significantly decreased ($P \leq 0.01$) in normal senile diabetic rats given the aqueous or ethanolic extract of *Balanites aegyptiaca* fruits or after 30 days of treatment compared to control: Similar decrease in γGT activity was observed in senile diabetic rats drenched either aqueous or ethanolic extract of *Balanites aegyptiaca* for 30 days.

Table (1): Effect of water and ethanolic extract from *Balanites aegyptiaca* fruits flesh on some biochemical parameters in senile diabetic rats for 30 days administration.

Parameters \ Criteria		Normal senile diabetic rats (control)	Senile diabetic rats treated with aqueous extract	Senile diabetic rats treated with ethanolic extract
Serum glucose mg/dl	Mean ± S.E. probability	225.5 2.15	137.6 3.20 P< 0.01	131.8 4.13 P< 0.01
Liver glycogen mg/g.tissue	Mean ± S.E. probability	8.42 0.24	12.8 0.63 P< 0.01	12.0 0.76 P< 0.01
Insulin μiu/ml	Mean ± S.E. probability	58.4 1.37	64.2 1.16 P< 0.05	70 1.15 P< 0.01
Glucagon Pg/ml	Mean ± S.E. probability	268.50 3.69	238.80 3.34 P< 0.01	225.20 4.09 P< 0.01
Leptin ng/ml	Mean ± S.E. probability	13.30 0.18	14.40 0.16 P< 0.01	15.20 0.26 P< 0.01
Testosterone ng/dl	Mean ± S.E. probability	490 8.50	560 8.10 P< 0.01	540 4.5 P< 0.01

Table (2): Effect of water and ethanolic extract from *Balanites aegyptiaca* fruits on liver function in senile diabetic rats for 30 days administration.

Parameters \ Criteria		Normal senile diabetic rats (control)	Senile diabetic rats treated with aqueous extract	Senile diabetic rats treated with ethanolic extract
Total lipids mg/dl	Mean ± S.E. probability	452.2 2.20	420.6 3.25 P< 0.01	399.2 3.07 P< 0.01
Total cholesterol mg/dl	Mean ± S.E. probability	161.4 2.44	148.8 2.01 P< 0.05	133.4 2.01 P< 0.01
Triglycerides mg/dl	Mean ± S.E. probability	120.10 3.16	93.2 3.33 P< 0.01	91.2 2.78 P< 0.01
Total protein g/dl	Mean ± S.E. probability	5.56 0.38	6.80 0.10 insignificant	6.42 0.25 insignificant
Albumin g/dl	Mean ± S.E. probability	3.38 0.31	3.78 0.40 insignificant	4.18 0.65 insignificant
Globulin g/dl	Mean ± S.E. probability	2.14 0.08	2.62 0.05 insignificant	2.40 0.06 insignificant
AST u/ml	Mean ± S.E. probability	35.80 1.59	28.40 0.98 P< 0.05	25.80 0.79 P< 0.01
ALT u/ml	Mean ± S.E. probability	38.90 1.01	30.85 1.59 P< 0.01	29.5 1.80 P< 0.01
γGT u/l	Mean ± S.E. probability	28.68 1.70	18.42 1.40 P< 0.01	22.84 1.60 P< 0.01

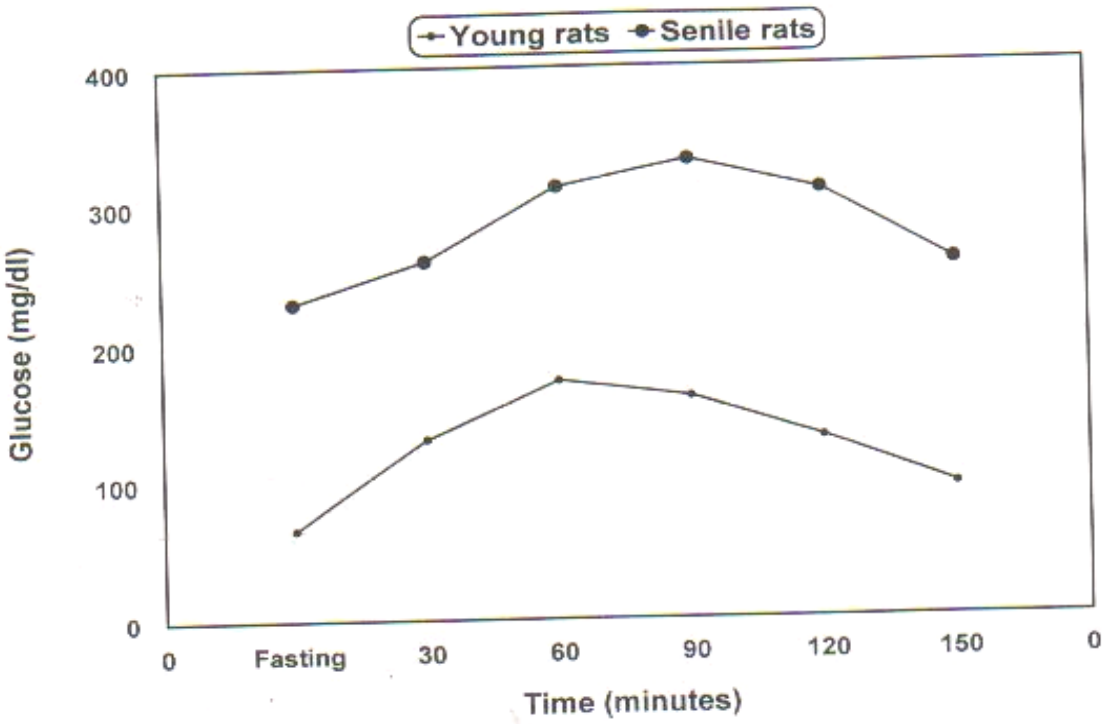


Fig. (1) : Blood glucose tolerance curve of young and senile rats.

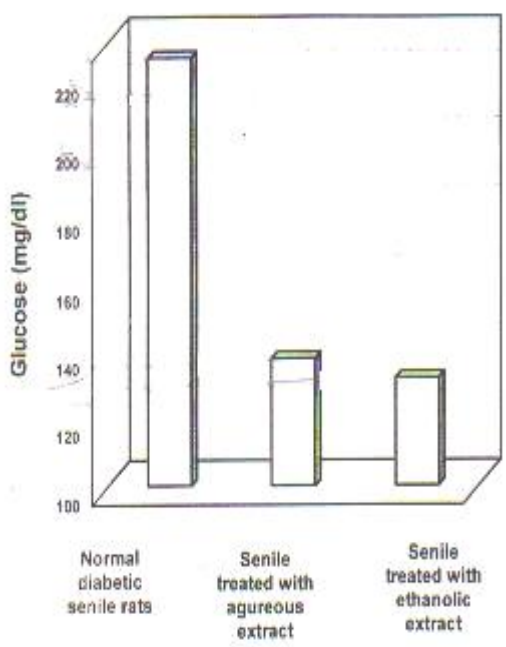
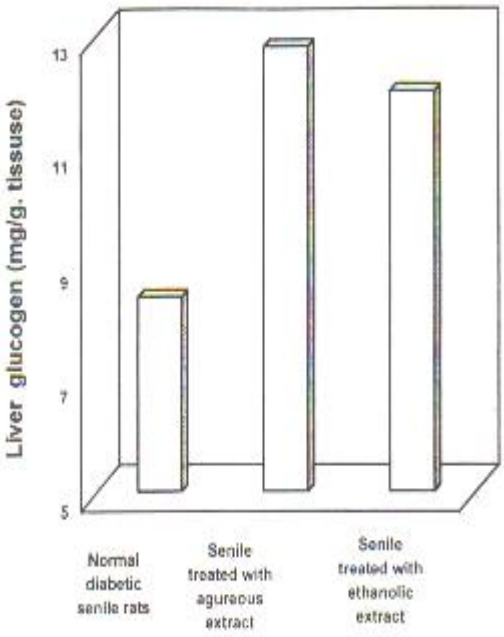


Fig. (2)



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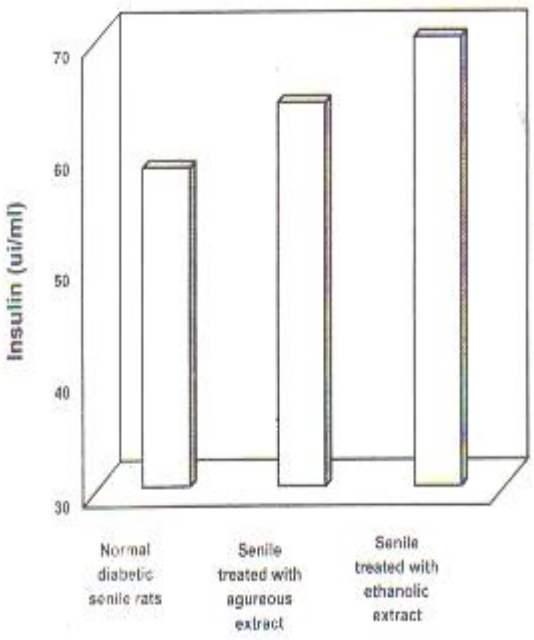

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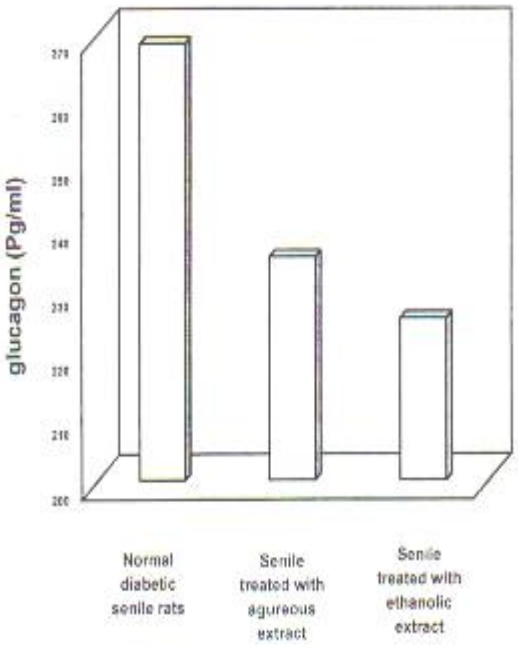


Fig. (5)

Effect of aqueous and ethanolic extract from *Balanites aegyptaca* fruits in senile diabetic rats for 30 day administration

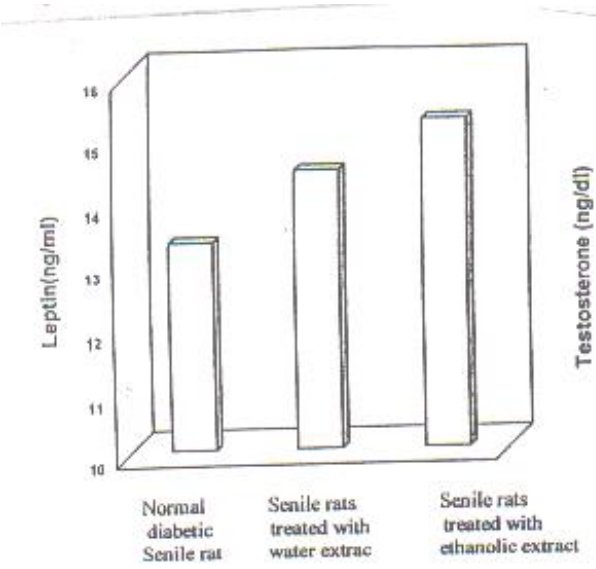
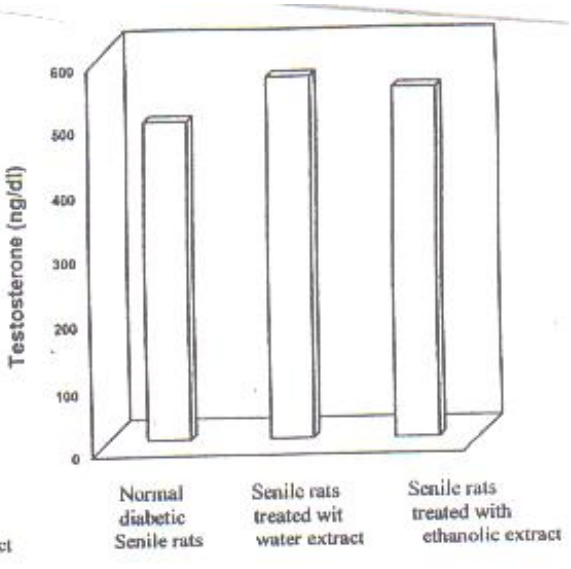


Fig. (6)



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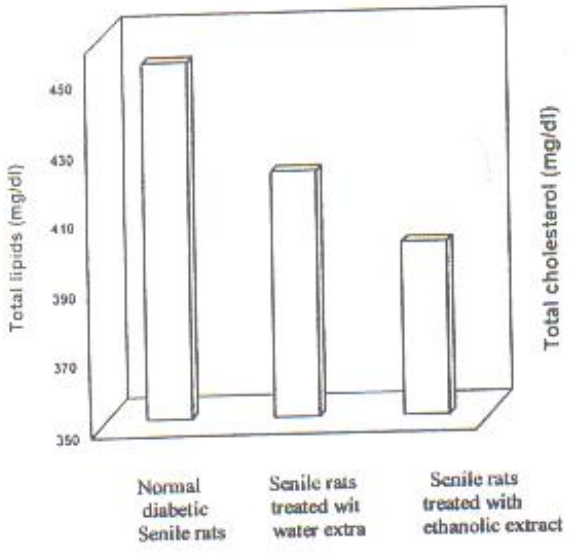

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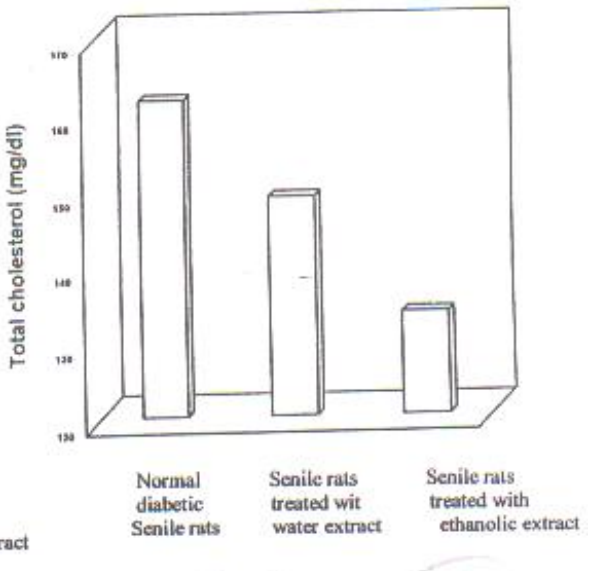


Fig. (9)

Effect of water and ethanolic extracts from fruit flesh of *Balanites aegyptiaca* in senile diabetic rats for 30 days of oral administration.

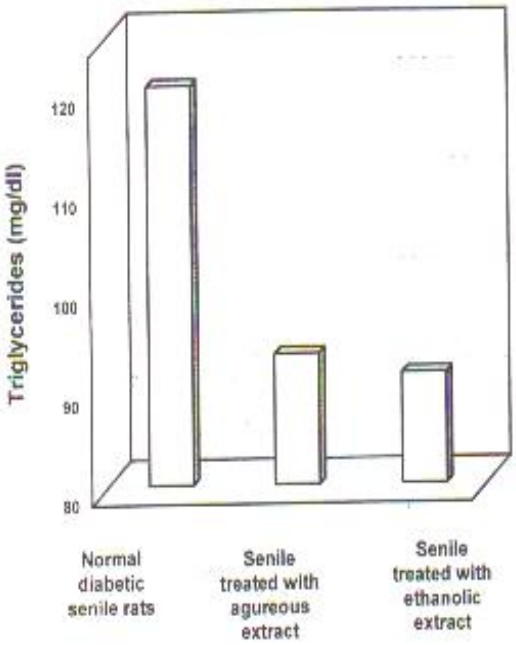


Fig. (10)

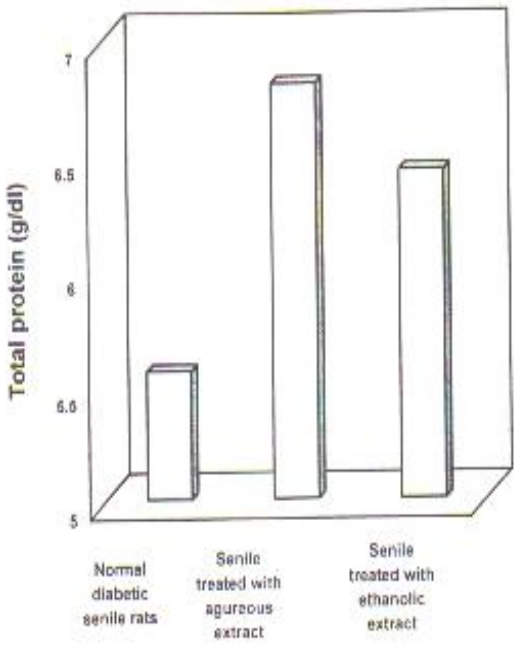


Fig. (11)

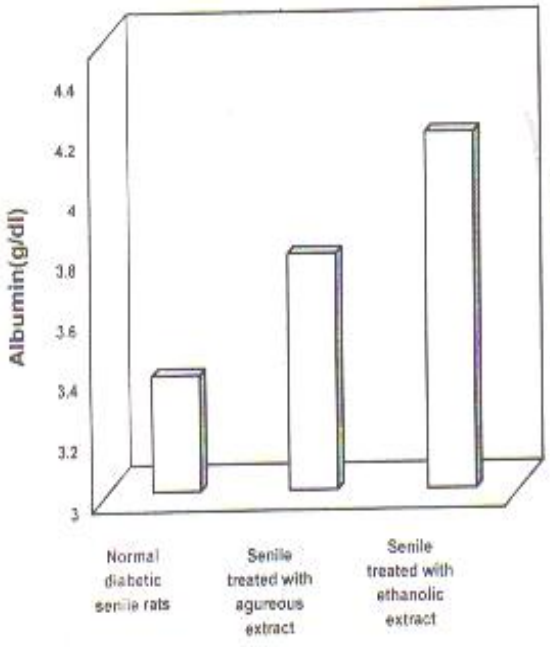


Fig. (12)

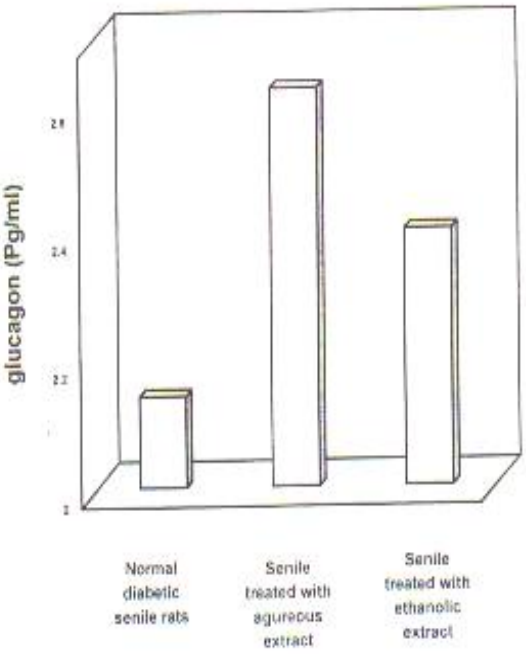
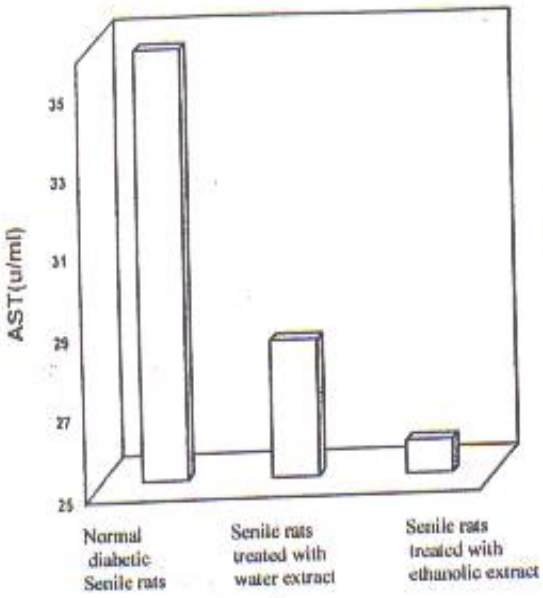


Fig. (13)

Effect of aqueous and ethanolic extract from *Balanites aegyptaca* fruits in senile diabetic rats for 30 day administration



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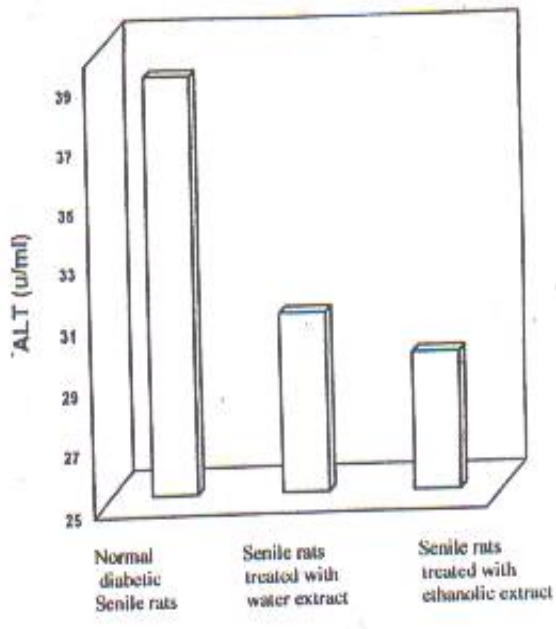

Fig. (15)

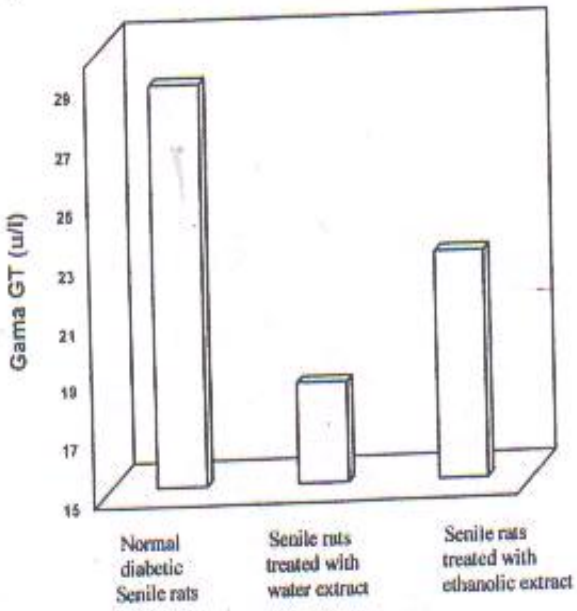

Fig. (16)

Effect of water and ethanolic extracts from fruit flesh of *Balanites aegyptiaca* in senile diabetic rats for 30 days of oral administration.

Discussion

Diabetes mellitus is a syndrome initially characterized by a loss of glucose homeostasis (Wolff, 1993). In the present study, some aspects of carbohydrate, protein and fat metabo - lism and liver function parameters were studied in the normal senile diabetic rats treated with either aqueous or ethanolic extract of *Balanites aegyptiaca* fruit flesh at a dose of (800 mg/kg body weight).

The administered extract of *Balanites aegyptiaca* fruit flesh prod - uced significant lowering in the serum glucose level. It was reported (Abdel-Moneim, 1998) that *Balanites aegyp - tiaca* induced a stimulation of islet insulin release and also, it potentiated the glucose stimulation to insulin secretion. It was suggested that the hypoglycemic activity may be generally mediated through enhancement of peripheral metabolism of glucose and an increase in insulin release (Skim *et al*., 1999) or may be due also to an intestinal reduction of the absorption of glucose (Aderibigbe *et al*., 1999).

The observed hypoglycemic action accompanied by increased serum insulin in animals drenched *Balanites aegyptiaca* fruit extract may be due. The elevation of hepatic glycogen observed in treated animals, indicates increased glucose storage as a result of increased insulin glycogenesis induced by high level (Kamel *et al*. 1991, Rawi *et al*. 1996). The activation of β.cells of pancreatic islets, stimulation of insulin release or increase the number and/or affinity of insulin receptors on target cells and the post receptors of these cells (Abdel-Moneim 1998). Moreover, the hypoglycemic effect of either aqueous or ethanolic extract of *Balanites aegyptiaca* fruits may be attributed to increase in islet numbers and to its effect on the time course of glucose absorption from the intestine (Abdel-Moneim, 1998).

The decrease of serum glucagon in senile diabetic rats treated with either aqueous or ethanolic extract of *Balanites aegyptiaca* fruits may be attributed to the marked decrease of □-cells in the islets. This attribution was suggested by Begum and Bari (1985).
Leptin is one of the polypeptide hormones which is releases from adipocytes. Its production is controlled by the *ob*/gene. It reverses the symptoms of a rare form of diabetes (Anna and Jane DeMoury 2002). Lipten inhibits food intake and stimulates energy expenditure which lowers body weight (Caro *et al*. 1996, Havel 1996 and Auwerk and Staels (1998). It is known that leptin receptors are expressed in a variety of peripheral tissues. It is thought that the hormone has to be transported into the central nervous system to exert its food suppressing and body weight lowering action (Auwerk and Staels 1998). Aqueous or ethanolic extract of *Balanites aegyptiaca* fruits increased serum leptin level compared to control or normal senile diabetic rats (Havel *et al*., 1996). Insulin and leptin correlated to each other. The increase in circulating leptin might contribute to the increase in circulating insulin, as circu - lating leptin has been shown to correlate to insulin secretion (Ahren *et al*. 1997).

The present study showed a decrease of serum total lipids, total cholesterol and triglyceride levels of senile diabetic rats after treatment with either water or ethanolic extract of *Balanites aegyptiaca* fruit flesh for 30 days compared to normal senile diabetic rats. The reduction of total lipids, cholesterol and triglycerides in senile diabetic rats of the present study may be

attributed to increased clearance and decreased production of the major transporters of endogenously synth - esised total cholesterol and triglycerides (Rawi *et al*., 1998). All these observ - ations indicated the hypolipidemic effect of Balanites aegypticaca fruits (Rai, 1997). A similar affect was reported by Roa *et al*., (1999), Sharma *et al*., (1997), Pepato *et al*., (2001) and Chen *et al*. (2001).

Treatment of senile diabetic rats in the present study, with either water or ethanolic extract of *Balanites aegyp - tiaca* fruits produced marked decreases of serum total lipids total cholesterol and triglyceride concentration as compared with the normal senile rats (non treated ones). This may be due to the role of *Balanites aegyptiaca* in increase over mobilization of lipids from blood vessels to liver or decrease lipogenesis mechanism in liver and decrease the mobilization of lipids from liver to the blood vessels.

Cholesterol-lowering effects of Balanites aegypticaca fruit extract either with water or ethanol, may be due to increased utilization of cholesterol for bile synthesis in the liver (Chautan *et al*., 1990). Another possibility is that the extract may effect cholesterol synthesis which seems to be decreased as a result of inhibition in hydroxy methyl glutaryl co-enzyme a reductase (Field *et al*., 1985), a rate limiting enzyme in the cholesterol biosynthesis path way. It is also possible that it exerts its effect on cholesterol esters of polyunsaturated fatty acids which are more rapidly metabolized by liver and other tissues, which might enhance their rate of turnover and excretion.

The reason for triglyceride-lowering effect of water or ethanol extract of *Balanites aegyptiaca* fruits could be contributed to a reduced availability of free fatty acid for hepatic uptake and triglyceride synthesis release with subsequent hypotriglyceridemia.

The obtained data indicated that water or ethanol extract of *Balanites aegypt - iaca* fruits produced no-significant effect on serum total protein, albumin and globulin concentration of senile diabetic rats after 30 days. These results imply that administration of the extract might adversely interfere with glycae - mic control in senile diabetic rats. Extract of *Balanites aegyptiaca* fruit flesh slightly improved serum protein and albumin concentration in compa - rison with normal senile diabetic rats (control).

Administration of either water or ethanolic extract of *Balanites aegyp - tiaca* fruits revealed a significant decrease ($P \leq 0.01$) in the activities of serum alanine aminotransferase (ALT), aspartate aminotransferase (AST) and gamma aminotransferase (γGT) of senile diabetic rats compared to control group. The decrease of these transami - nase activity with the treatments have been attributed to improved liver function (Werman *etal*., 1989 and Rawi, 1998).

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الخواص المضاده لمرض السكر للمستخلص المائى والكحولى للحم ثمرة بلح بلانيتس إيجيبتياكا فى الجرذان المسنة المصابة بالسكر

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وضعت الدراسة الحالية لتقييم دور النباتات الطبية فى علاج مرض السكر كبديل للأدوية المصنعة والتى ينتج عنها بعض المضاعفات. ولذا كان لاستخدام النباتات الطبية فى علاج السكر فائدة عظيمة لأنها مؤثرة وغير سامة وأكثر أمناً من الأدوية المصنعة.

وقد تم إختبار تأثير المستخلص المائى أو الكحولى لثمرة بلح الهجليج (بلانيتس إيجيبتياكا) فى الجرذان المسنة على إنخفاض معدل السكر ونسبة الدهون بالجسم بالإضافة إلى تأثيرها على بعض الهرمونات التى لها علاقة بالسمنة والبول السكرى. لقد عرف من زمن قريب أن كل من هرمون الليبتين والإنسولين يلعبا دوراً هاماً ومفيداً فى تنظيم التوازن الطاقى ووزن الجسم بالإضافة إلى تخفيض معدل السكر بالدم.

وقد أظهر المستخلص المائى أو الكحولى إنخفاضاً ذو دلالة معنوية لسكر الدم، هرمون الجلوكاجون والدهون الكلية والكوليستيرول الكلى والدهون الثلاثية (الجليسريدات الثلاثية) ونشاط الإنزيمات الناقلة لمجموعة الأمين (γGT, AST, ALT). بينما أظهر محتوى الجليكوجين الكبدى ومعدل الأنسولين وهرمون الليبتين وهرمون التستوسيزون فى مصل الدم إرتفاعاً ذو دلالة معنوية. ومن ناحية أخرى لم تظهر النتائج أى تغير فى المحتوى الكلى للبروتينات، الألبيومين والجلوبيولين فى مصل الدم خلال فترة التجربة. وأوضحت الدراسة الدور الهام والمفيد لثمرة الهيجليج (بلانيتس إيجيبتياكا) فى إنخفاض معدل السكر فى مصل الدم وكذلك إنخفاض معدل دهنيات مصل دم الجرذان المسنة وكذلك حماية الكبد من التلف والتليف.

وقد إستنتج أن ثمرة الهيجليج (بلانيتس إيجيبتياكا) لها تأثير فعال على إنخفاض معدل السكر وكذلك دهنيات فصل الدم. كما تؤدى إلى إنطلاق الإنسولين من خلايا بيتا الموجودة فى البنكرياس كما تؤدى إلى تقليل إمتصاص السكر من الأمعاء كما تقلل فرص إستخدام الجلوكوز بواسطة الحجاب الحاجز للجرذ. كما يؤدى إستخدام بلانيتس إيجيبتياكا إلى إنخفاض عملية تخليق الجلوكوز المتمثلة فى عملية الجلوكونيوجينيسس وعملية تحلل الجليكوجين (جليكوجينوليسيس) المعروفة بعملية إنتاج الجلوكوز من الكبد وهى ضمن دور بلج الهليج فى إنخفاض معدل سكر فصل الدم.