Egyptian Herbal Monograph

Volume 1

Traditional wild medicinal plants

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Balanites aegyptiaca L. Delile هجليج

1. Names & Synonyms

***Balanites aegyptiaca* L. Delile**. (1).
Family: Zygophyllaceae (2).
Syn.: *Ximenia aegyptiaca* L. (1).
Arabic: Higleeg هجليج, Shaashoat & Balah Haraara (names used by the Halaib Triangle Community) شاشوت و بلح حرارة (الثمار) (2).
English: Thorn tree, Egyptian balsam, Zachum oil tree, Desert date, Soap berry bush (2, 3).

2. Geographical distribution

Distributed in most of the phytogeographical regions of Egypt except those of the Mediterranean and Red Sea coastal strips (2).

3. Parts used for medicinal purposes

- The fruit.

However, various parts of *B. aegyptiaca* have their own traditional medicinal properties worldwide (2).

4. Major chemical constituents

- **Fruits:** fruit pulp is a good source of sugars (33g/100g dry matter (DM), polyphenols (264mg GAE/100g DM) and flavonoids (34.2mg/100g DM). The fruit kernel is rich in lipids (46.2g/100g DM) and proteins (29.5g/ 100g DM) (4). However, saponins, referred to as balanitinis, remain by far the most reputed chemical constituents of the *B. aegyptiaca* fruit, representing 7.2% in the pulp and 6.7% in the kernel (5).
- **Other constituents in the fruits:** Alkaloids, flavonoids, tannins and vitamins (4).

The plant is reported to contain 5.6% diosgenin. Diosgenin is a type of sapogenin compound which have been isolated from seed, leaves and fruit of *B. aegyptiaca* (6).

5. Traditional medicinal uses

In Egyptian folk medicine, the fruits are used as oral antidiabetic drug (7, 4).
Worldwide, *B. aegyptica* has multiple applications with almost every part of the plant; It is traditionally used in treatment of various ailments *i.e.* jaundice, intestinal worm infection, wounds, malaria, syphilis, epilepsy, dysentery, constipation, diarrhea, hemorrhoid, stomach aches, asthma and fever (8).

***B. aegyptica* is a traditional medicinal plant for use in the specified indications exclusively based upon long-standing use.**

6. Herbal preparations correlated to medicinal use

1. Fleshy pulp of the fruit is eaten fresh or dried (9).
2. Lozenges, the fruits are sucked (10).
3. Decoction (10).

7. Posology and method of administration correlated to medicinal use

At this time there is not enough scientific information to determine an appropriate range of doses for *B. aegyptica*. The appropriate dose depends on several factors such as the user's age, weight, health and several other conditions.

Method of administration: Oral.

8. Contraindications

Hypersensitivity to active substances and to other plants of the same family.

9. Special warnings and precautions for use

- Monitoring of blood glucose level should be done regularly.
- If the symptoms worsen during the use of the medicinal product, a doctor or a pharmacist should be consulted.

10. Interactions with other medicinal products and other forms of interaction

None reported.

11. Fertility, pregnancy and lactation

- Nothing was reported in Egyptian folk medicine about the effect of *B. aegyptiaca* in Fertility, pregnancy and lactation; while, in Sudanese folk medicine, macerated

fruit mixed with millet to make porridge given to women, after childbirth and during lactation, to give them energy, strength and to increase milk production (11).

- In the context of fertility and pregnancy; Studies have shown fertility effects of *B. aegyptiaca* and reported that the use should be avoided during pregnancy (8, 12).

12. Effects on ability to drive and use machines

No studies on the effect on the ability to drive and use machines have been performed.

13. Undesirable effects

- None reported.
- If adverse reactions occur, a doctor or a pharmacist should be consulted.

14. Overdose

- No case of overdose has been reported.

15. Relevant biological activities

- Aqueous extract of fruits showed spermicidal activity without local vaginal irritation in human being, up to 4% sperms becoming sluggish on contact with the plant extract and then immobile within 30 s; the effect was concentration related. Protracted administration of the fruit pulp extract produced hyperglycemia induced testicular dysfunction in dogs (8).
- Oral administration of *B. aegyptiaca* mesocarp extract (259 mg/kg) and *B. aegyptiaca* crude saponin (90 mg/kg) to pregnant-rats for the first 10 days of pregnancy produced post-coital antifertility. In addition, *B. aegyptiaca* saponins produced regression effect on the size of the implants observed on day 11 of pregnancy upon laparotomy, as well as a delay of delivery for up to 23-26 days compared to control group (23days). Mortalities were observed within newborn (12).
- The aqueous extract of *B. aegypticea* has hypoglycemic properties. It can decrease the plasma glucose level and can improve weight in diabetic experimental animals. 800 mg/kg aqueous extract decreased significantly the plasma glucose level ($P \leq 0.05$) in diabetic rats, and there is a considerable gain in body weight ($P \leq 0.05$) compared to the diabetic control group. 400mg/kg aqueous extract has a mild effect on body weights and plasma glucose levels, while 200 mg/kg aqueous extract has no significant effect on plasma glucose level and a little effect on body weight (13).

- The whole and extracted pulp of *B. aegyptiaca* fruits were reported to exhibite a hypocholesterolemic effect when tested on adult albino rats (14).
- The methanol extract of the pulp was found to exhibit anti-dermatophytic activity on *Microsporum gypseum* and *Trichophyton rubrum* (15).
- Hard gelatin capsules (400 mg/day) were tested on 30 type 2 diabetes (T2D) Egyptian patients for 8 weeks. According to sex, age and body mass index participants were divided into two equivalent groups, placebo and treatment. At the end of the 8-week treatment, the treated group showed 26.88% decrease in 2 h postprandial plasma glucose relative to 2.6% increase in the placebo group, while fasting plasma glucose was reduced to 10.3%. Treatment with BE capsules for 8 weeks produced significant reduction in the plasma triglyceride, total cholesterol and low-density lipoprotein cholesterol by 9.0, 12.76 and 21.35%, respectively, with 29.8% increase in the high-density lipoprotein cholesterol. Plasma alanine transaminase and aspartate transaminase were reduced by 42.6 and 43.3%, respectively (16).
- The potential antidiabetic and antioxidant impact of *B. aegypticea* fruits water extract (1.5 g/kg BW daily for 45 days) on streptozotocin-induced diabetic and normal rats were evaluated. The influences of the extract on body weight, plasma glucose, insulin, total antioxidant capacity (TAC), malondialdehyde (MDA) levels, and liver-pyruvate kinase (L-PK) levels were assessed. Furthermore, the weight and histomorphological changes of the pancreas were studied in the different experimental groups. The herbal preparation significantly reduced the mean plasma glucose and MDA levels and significantly increased the mean plasma insulin, L-PK, and TAC levels in the treated diabetic groups compared to the diabetic control group. An obvious increase in the weight of the pancreas and the size of the islets of Langerhans and improvement in the histoarchitecture were evident in the treated groups compared to untreated ones. In conclusion, the study provides scientific evidence for the traditional use of the extracts as antidiabetic and antioxidant agents in type 1 diabetes mellitus (17).
- *B. aegyptiaca* fruits as herbal tea showed hypoglycemic, anti-hyperlipidemic, and antioxidant effect in streptozotocin-induced diabetes mellitus in rats. Moreover, ameliorated liver and kidney functions associated with diabetes mellitus. All the different concentrations of *B. aegyptiaca* fruits tea (0.25, 0.5, and 1.0%) improved biomarker parameters compared to diabetic control and some biochemical parameters return to normal value. The most efficient concentration of *B. aegyptiaca* fruits tea was 1.0 g/100 ml. This makes *B. aegyptiaca* fruits applicable health product for treatment of diabetes mellitus (18).
- The saponin rich fraction of the butanol extract of *B. aegyptiaca* fruits showed significant aldose reductase inhibitory activity. These findings are of significant importance, because furostanol saponins have rarely been previously reported to

display aldose reductase inhibitory activity. Five new furostanol saponin derivatives isolated from fraction showed substantially higher activities than the crude butanolic extract and were highly active compared to the reference compound, quercetin. These isolated compounds may represent promising lead structures for novel or alaldose reductase drug development, depending on their bioavailability and safety profiles, which will be tested in appropriate future *in-vivo* and clinical studies. The findings for *Trigonella foenumgraeceum*, however, indicate that the furostanol saponins isolated from *B.aegyptiaca* may have more than one potential mechanism of action contributing to the antidiabetic activity, and that further studies on the disaccharidase and glycogen enzymatic activity modulation would be useful (19).

- The effect of fruit fleshes crude extract (70% ethanol), butanol, and dichloromethane fractions from *B. aegypticea* (50 mg/kg BW for one month) on the stress-activated protein kinase/c-Jun N-terminal kinase (SAPK-JNK) pathway in experimental diabetic rats was evaluated. The results suggested a protective role of treatment of diabetic rats with *B. aegypticea* against oxidative stress-induced SAPK-JNK pathway. Moreover, *B. aegypticea* treatment produced a reduction in plasma glucose, HbA1c, lactic acid, lipid profile, malondialdehyde levels and produced an increase in insulin. Reduction in glutathione levels, catalase and superoxide dismutase activities were observed compared with untreated diabetic rats. Moreover, it decreased apoptosis signal-regulating kinase 1, c-Jun N-terminal kinase 1, protein 53 and increased insulin receptor substrate 1 in rat pancreas while it increased glucose transporter 4 in rat muscle. In conclusion, *B. aegypticea* exerted hypoglycemic, hypolipidemic, insulinotropic and antioxidant effects. Additionally, it reduced apoptosis in pancreatic β-cells and increased glucose uptake in muscle. These results suggest that the hypoglycemic effect of *B. aegypticea* is due to the inhibition of the SAPK-JNK pathway (20).
- Oral administration of *Balanites* extract (1.5 g/kg) to STZ diabetic rats significantly reduced blood glucose level by 24% after 21 days of treatment. However, *Balanites*, under the conditions of the experiment, did not significantly affect the reduced serum insulin level of diabetic rats (21).
- Alcoholic extracts of fruit of an endangered medicinal plant *Balanites aegyptiaca* and its in vitro raised calli were analyzed for antimicrobial potential against various Gram positive and Gram- negative bacteria including those harbouring blagenes by agar well diffusion method. The alcoholic extract of parent plant as well as its callus showed good antibacterial activity against both Gram- positive and Gram-negative bacteria. Minimum inhibitory concentrations (MIC) of the extracts were determined by broth microdilution method. MIC against Gram positive bacteria ranged from 3.05 to 24.0 µg/ml, while MIC against Gram negative bacteria ranged from 1.53 to 49.0 µg/ml and MIC against resistant bacteria. harbouring blagenes ranged from 12.0 to 49.0 µg/ml. The present study shows that

extracts of *B. aegyptiaca* contain good antibacterial activity which can be used in the treatment of various infectious diseases. As its calli also gave good results (22).

- The antibacterial activity of the *Balanites aegyptica* oil at different concentrations on *staphylococcus aureus* and *Escherichia coli* bacteria and different meters in diameter of the zones was observed. The results shows significant effect of Balanites oil on bacteria by observing the presence of clear spaces known as the zone of inhibitions in the experiments (23).
- The Balanites aegyptiaca fruits are eaten by humans and animals and have many benefits. The fruits of the desert date contain oil, protein, sugar, vitamins, mineral salts, soap, and diosgenin. The oil is used in the cosmetic industry and is also used in the treatment of rheumatism, as well as some diseases that affect the reproductive system, sex hormones, infertility, and fertility diseases. Many scientific reports *Balanites aegyptiaca* mention the biological activities antioxidant, anticancer, antimicrobial, insecticidal activities of balanite kernel oil (24).

16. Additional information

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17. Date of compilation/last revision

13/10/2022.

References

1	Boulos, L. (2000). Flora of Egypt, Al Hadara Publishing, Cairo, Egypt.
2	Mohamed A, El-Shanawany (2017). *Balanites aegyptiaca* (L.) Del. In: Egyptian Encyclopedia of Wild Medicinal Plants, **3**, 212-234. Academy of Scientific Research and Technology, Cairo, Egypt.
3	Batanouny, K. H. (1999). Wild Medicinal Plants in Egypt (with contribution: Aboutabl, E., Shabana, M. and Soliman, F.). Academy of Scientific Research and Technology, Egypt. The World Conservation Union (IUCN).
4	Abdelaziz, S. M., Lemine, F. M. M., Tfeil, H. O., Filali-Maltouf, A. and Boukhary, A. O. M. S. (2020). Phytochemicals, antioxidant activity and ethnobotanical uses of *Balanites aegyptiaca* (L.) Del. fruits from the arid zone of Mauritania, Northwest Africa. *Plants*, **9**, 401.
5	Yadav, J. P. and Panghal, M. (2010). *Balanites aegyptiaca* (L.) Del. (Hingot): A review of its traditional uses, phytochemistry and pharmacological properties. *Int. J. Green Pharm*., **4**, 140–146.
6	Hammouda, F. M., Ismail, S. I., Abdel-Azim, N. S. and Shams, K. A. (2005). A Guide to Medicinal Plants in North Africa (Batanouny K. H., editor). IUCN Centre for Mediterranean Cooperation. Malaga.
7	Kamel, M. S. (1998). A furostanol saponin from fruits of *Balanites aegyptiaca*. *Phytochemistry*, **48**(4), 755-757.
8	Chothani, D. L. and Vaghasiya, H. U. (2011). A review on *Balanites aegyptiaca* Del (desert date): phytochemical constituents, traditional uses, and pharmacological activity. *Pharmacog. Rev*., **5**(9), 55-62.
9	Tesfaye, A. (2015). Balanites (*Balanites aegyptiaca*) Del., multipurpose tree a prospective review. *International Journal of Modern Chemistry and Applied Science*, **2**(3), 189-194.
10	Conservation and Sustainable Use of Medicinal Plants in Egypt, National Surveys. (2016). UNDP, GEF, ASRT and NRC, Volumes **1-5**.
11	Abdelmuti, O. M. S. (1991). Biochemical and nutritional evaluation of famine foods of the Sudan. Ph.D. Thesis, Faculty of Agriculture-Khartoum: University of Khartoum, Sudan.
12	Babiker, M. N. E. (1988). Pharmacological and Phytochemical Studies on *Balanites aegyptiaca* Fruits. M.Sc. Thesis. University of Khartoum, Sudan.
13	Baragob, A. E. A., AlMalki, W. H., Shahid, I., Bakhdhar, F. A., Bafhaid, H. S. and Eldeen, O. M. I. (2014). The hypoglycemic effect of the aqueous extract of the fruits of *Balanites aegypticea* in alloxan-induced diabetic rats. *Pharmacogn. Res*., **6**(1), 1-5.
14	Abdel-Rahim, E. A.; El-Saadany, S. S. and Wasif, M. M. (1986). Biochemical dynamics of hypocholesterolemic action of *Balanites aegyptiaca* fruit. *Food Chem*., **20**, 69–78.
15	Hussain, S. A. M.; Velusamy, S. and Muthusamy, J. (2019). *Balanites aegyptiaca* (L.) Del. for dermatophytoses: Ascertaining the efficacy and mode of action through experimental and computational approaches. *Inform. Med. Unlocked*, **15**, 100177.

16	Rashad, H., Metwally, F. M., Ezzat, S. M., Salama, M. M., Hasheesh, A. and Abdel-Motaal, A. (2017). Randomized double-blinded pilot clinical study of the antidiabetic activity of *Balanites aegyptiaca* and UPLC-ESI-MS/MS identification of its metabolites. *Pharmaceutical Biology*, **55**(1), 1954–1961.
17	Abou Khalil, N. S., Abou-Elhamd, A. S., Wasfy, S. I. A., ElMileegy, I. H., Hamed, M. Y. and Ageely, H. M. (2016). Antidiabetic and antioxidant impacts of desert date (*Balanites aegyptiaca*) and parsley (*Petroselinum sativum*) aqueous extracts: Lessons from experimental rats. *Journal of Diabetes Research*, **10**. doi: 10.1155/2016/8408326.
18	Ghanem, K. Z., Ghanem, H. Z., Ramadan, M. M. and Mabrok, H. B (2016). The effect of herbal tea from *Balanites aegyptiaca* fruits on streptozotocin-induced diabetes mellitus in rats. *International Journal of PharmTech Research CODEN (USA): IJPRIF*, **9**(10), 8–15.
19	Abdel Motaal, A., ElAskary, H., Crockett, S., Kunert, O., Sakr, B., Shaker, S., Grigore, A., Albulescu, R. and Bauer, R. (2015). Aldose reductase inhibition of a saponin- rich fraction and new furostanol saponin derivatives from *Balanites aegyptiaca. Phytomedicine*, **22**, 829–836.
20	Hassanina, K. M. A., Mahmoud, M. O., Hassan, H. M., Abdel-Razik, A. H., Aziz, L. N. and Rateb, M. E. (2018). *Balanites aegyptiaca* ameliorates insulin secretion and decreases pancreatic apoptosis in diabetic rats: Role of SAPK/JNK pathway. *Biomedicine & Pharmacotherapy*, **102**, 1084–1091.
21	Gad, M. Z., El-Sawalhi, M. M., Ismail M. F. and El-Tanbouly N. D. (2006). Biochemical study of the anti-diabetic action of the Egyptian plants Fenugreek and Balanites. *Molecular and Cellular Biochemistry,* **281**, 173–183.
22	Noor, J. N., Razia, K. R., Shahzad, A. and Mohammad, S. M. (2013). Antimicrobial activity of medicinal plant *Balanites aegyptiaca* Del. and its in vitro raised calli against resistant organisms especially those harbouring blagenes. *Journal of Medicinal Plants Research*, **7**(25), 1692-1698.
23	Khanam, S. and Galadima, Z. F. (2021). Antibacterial activity of *Balanites aegyptiaca* oil extract on *Staphylococcus aureus* and *Escherichia coli*. *Biorxiv Preprint,* doi: https://doi.org/10.1101/2021.03.23.436600.
24	Mariod, A. and Ismail, E. M. I. (2022). Biological activities of *Balanites aegyptiaca* (Heglig) kernel oil. In book. Multiple Biological Activities of Unconventional Seed Oils, **27**, 339-344.