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EVALUATION OF *BALANITES AEGYPTIACA* (L.) DEL FRUITS AS UNTRADITIONAL SOURCE OF OIL

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ABSTRACT

Nutrient composition of *Balanites aegyptiaca* (BA) fruits (kernel and pulp) and physicochemical characteristics of its kernel oil were determined. Also the influence of diet supplemented with BA kernel oil on serum lipid profile, liver and kidney functions in rats were studied. Furthermore the anticancer activity; cytotoxicity of the oil on breast, larynx, colon and liver human tumor cell lines tested using sulphorhodamine B (SRB) assay were also studied representing different oriental cancer types. Results raveled that the kernel had distinguished by its high content of oil (47%), protein (37.48%) and minerals, the major fatty acid was linoleic (40.65%) and β-sitosterol (21.53%) was the predominant sterol in the sterol fraction. Whereas carbohydrates was the major constituent of the pulp (63.81%). Also, Results revealed that, the serum total cholesterol concentrations of rats fed with diet include BA kernel oil were significantly lower after 6 weeks. HDL-cholesterol levels were significantly increased in BA groups after 3 and 6 weeks as compared to the control group. It was also, noticed that the supplementations of *Balanites aegyptiaca* kernel oil had no significant effect on blood lipid profile or liver and kidney functions.

Keywords: Nutrition composition, *Balanites aegyptiaca* oil, physicochemical characteristics, Heglig oil, liver and kidney function, Cytotoxicity.

INTRODUCTION

Balanites aegyptiaca (L.) Del Zygopyllaceae also known Desert date in English, 'dattier du desert' in Frensh, 'heglig' in Arabic is one of the most widely distributed trees in Africa **(Hall and Walker, 1991).** Although found almost everywhere in the continent, very high concentration of the tree are most prevalent in Sahel and Sudan Savanna zones of West Africa and semi aired regions of East Africa **(Shanks and Shanks, 1991)**. *Balanites aegyptiace* is a highly drought-tolerant evergreen desert plant spices. In Egypt *Balanites aegyptiaca* trees are grown in different regions El-Kharga and El-Dakhla Oasis in Eastern desert and Southern Aswan **(Abdel-Rahim, 1986)**. Egypt is suffered from a big gap in oil production (more than 90% exported from foreign countries), therefore, the government have to search for new industrial oil crops. *Balanites aegyptiaca* may be considering as suitable untraditional source of oil for a partially overcome the problem in oil production.

Every part of Balanites *aegyptiaca* trees has economic importance. Its roots and bark are used for fishing, the wood as yoke for drought animals and hand implements or furniture's, while human eat the leaves and flesh of the ripe fruits because they are rich in carbohydrates and vitamins. The most important part of Balanites *aegyptica* tree is the nut, also, called stone. The nut is obtained after the removal of the flesh and pulp of the fruit and it contains a kernel with oil and protein contents ranging from 30-60% and 20-30%, respectively. The oil good for cooking as it has an acceptable sent and taste **(Hall and Walker. 1991)**, and does not smoke excessively when heated. The kernel meal remaining after oil extraction can be used as livestock feed **(Abu-Alfutuh, 1983)**. *Balanites aegyptiaca* has been found to have high potential for industrial applications because saponins, which are used as basic raw material in the manufacture of soap, candle, chemicals and cosmetics as well as pharmaceutical products, can be extracted from any part of the tree.

Processing of *Balanites aegyptiaca* fruit involves soaking in cold water for three days or hot water for a day and washing off the pulp to obtain the nut. The nut is sun-dried for two days, if cold water was used and for eight hours if hot water was used to soak the fruit .The kernel is obtained from the nut by cracking with stone on top of another stone or metal. Oil is extracted from the kernel by heating its

meal in a pan over an open fire or boiling it in a pot containing water **(Umar and Aviara, 2005)**.

Literature survey revealed few studies about the *Balanites aegyptiaca* with samples mainly from many countries in Africa , no study so far has been reported from sample from Egypt Governorates , where , Egypt is consider the native and origin homeland of *Balanites aegyptiaca* trees.Therefore, the present study was carried out to evaluate the nutrients content of *Balanites aegyptiaca* fruits (kernel and pulp) grown in Egypt and the physicochemical properties of kernel oil as well as its effect on kidney, liver functions and blood lipid profile of rats beside, efficiency of the oil as cytotoxicity agents against four human tumor cell lines (breast, larynx, colon and liver) were evaluated .

MATERIALS AND METHODS

Materials

Ripe fruits of *Balanites aegyptiaca* were obtained from the trees grown in El-Dakhla Oasis, Egypt. The epicarp (outer cover) and mesocarp (pulp) of the fruits were removed by hand and the nuts were washed with tap water. After washing, the nuts were oven dried at 40C for 72 h. Decortications of nuts were carried out by hand and released the kernel (approximately 27% of the nuts). The kernels were ground in the blender then, the oil was extracted. Hexane, chloroform, ethanol, methanol, were of analytical grade and purchased from Merck, (Darmstadt, Germany). Standards fatty acids and unsaponifiable matter (purity >99% by GLC) were purchased from Koch Light Laboratories, Ltd., (England). Reagents Methodology Kits were obtained from Biodiagnstic Research Reagents Co., Egypt.

Animals

Male white albino rats of Sprague-Dawely strains of 120 -135 g body weights were used in this study. The animals were kept individually in stainless steel cages at air condition 20-22º C and a relative humidity of about 55%.

Diet

A basal diet composed of 15% casein, 10% corn oil, 65 % starch, 5% fiber, 4% salt mixture and 1% vitamin mixture **(Compbell,**

1961) were prepared for feeding all groups of rats throughout the experiment period.

Experimental Design

Twelve male Sprague-Dawley rats were used in this study. The rats were divided into two groups (n=6), which were fed *ad libitum* the rat basal diet. After one week adaptation to the experimental regimen, the control group fed the basal diet throughout the experiment period, while, the other group fed the same basal diet except for using 10 % kernel oil only and administrated 1 ml of the tested oil daily by intragastric intubations. The diet was freshly prepared every five day, the diet and tested oils stored at –20 °C during the feeding period. The rats received fresh food daily. The experiment was continued for 45 days.

Methods

Oil extraction

Ground kernels were soaked in n-hexane for 24 hrs twice. Solvent was collected and evaporated under vacuum and the obtained oil was dried over sodium sulfate anhydrous, filtered, and kept in brown glass bottles at -20°C till analysis.

Proximate analysis of fruits

Moisture, ash, crude protein, crude fibers oil contents and mineral content were determined according to **A.O.A.C. (2005)**. The total carbohydrates content were calculated by difference.

Determination of amino acid profile of *Balanites aegyptiaca* kernel

Amino acid profile of defatted ground kernels was analyzed by using Amino Acid Analyzer, Biochrom 30, according to the method of **AOAC (2005)** .EZChrom (software was used for data collection and processing)

Preparation of polyphenol extracts

Twenty grams of defatted *Balanites aegyptiaca* kernels and pulp powder were extracted at room temperature using methanol for 48 hours. Extracts were filtered through Whatman paper no. 4, and the filtrate was concentrated under vacuum using rotary evaporator at ≤ 40°C and weighed to determined the yield of total phenolic content and then identified the phenolic components using HPLC.

Physical and chemical characteristics of *Balanites aegyptiaca* kernels oil

Refractive index at 25°C, specific gravity at 20°C, acid, peroxide, iodine, saponification values and unsaponifible matter were determined using the official method of **A.O.A.C. (2005).** Color was determined using **A.O.C.S. (1993)**. Oxidative stability of oil was measured at 100°C by the Rancimat method using a 679 Rancimat (Metrohm, Herisav, Switzerland) with air flow rate at 20 L/h following the method described by **Tsakins *et al* (1999).**

Determination of phenolic compounds

HPLC technique was used to determine phenolic compounds in *Balanites aegyptiaca* kernel and pulp. 1-3 ml of methanol extracts were filtered through 1 then 0.2 µm Millipore membrane filters and collect filtrate in vials for injection. HPLC Hewllet Packared HP 1050 series equipped with auto sampler injection, solvent degasser, UV detector set at 280 nm and quaternary pump series 1100. The column temperature was maintained at 35 C. Gradient separation was carried out with methanol and acertonirile as mobile phase at flow rate of 1 ml/min. phenlic acid standards from Sigma CO. were dissolved in a mobile phase and injected into HPLC. Retention time and peak area were used to calculation of phenolic compounds concentration by the data analysis of HP software

Gas chomatography analysis for fatty acids

Methylation of fatty acids

An aliquot of oils, about 10mg, was dissolved in 2ml hexane and then 0.4ml 2N KOH in anhydrous methanol was added **Cossignani et al. (2005**), after 3 min, 3ml water was added. The organic layer, separated, dried over anhydrous sodium sulfate, then concentrated with a N_2 stream to around 0.5 ml for GC analysis of fatty acids methyl esters (FAME) as described below.

Identification of fatty acids methyl esters by GLC

Agilent 6890 series GC apparatus provided with a DB-23 column (60m x 0.32mm x 0.25µm). Fatty acids methyl esters directly injected into the GC. Carrier gas was N_2 with a flow rate of 2ml/min, splitting ratio of 1:100. The injector temperature was 250°C and that of FID detector was 270°C. The temperature settings were as follows: 150° to 225°C at 5°C/min, and then held at 225°C for 20 min. Peak

identification was performed by comparison of the retention time (RT) for each peak with those of standard fatty acids. The peaks areas were measured using Chemstation Program, and relative areas of the identified fatty acids were recorded.

Identification of unsaponifiable matter fraction by GLC

Gas liquid chromatography apparatus, Agilent 6890 series GC apparatus provided with a DB-5 column (25m x 0.32mm x 0.25μm) and FID was used in the identification of unsaponifaible matter. The oven temperature was programmed at 10°C / min. from 70 to 270°C then isothermally at 270°C for 15 min. Temperatures of injection and detector were 250°C and 300°C, respectively. Gases flow rates were 30, 33, 300 ml/min for nitrogen, hydrogen and air, respectively. The chart speed was 2 ml/min and attenuation was 32 x 10^{-2}. The authentic samples were used as a guide to identify the unknown compounds by relative retention times. The unsaponifiable matter composition was expressed as percentage of total unsaponifiable matter.

Serum analysis

The methods reported by **Fawcett and Soctt (1960)** and **Schirmeister (1964)** were used for determination of Urea and Creatinine. Aspartate (AST) and alanine (ALT) amino transferase activites were determined following method of **Reitman and Frankel (1957)**. The activity of alkaline phosphatase was determined according to the method of **Belfield and Goldberg (1971)**. Enzymatic colorimetric methods were used for estimation of Triglycerides, Cholesterol, HDL-cholesterol and Total lipids by **Fassati and Prencip (1982), Richmond (1973), Burstein (1970) and Schimit (1964)**, respectively.

Measurement of potential cytotoxicity by sulphorhodamine B (SRB) assay

Potential cytotoxicity of BA kernel oil was tested using the method of **Skehan *et al.* (1990)** in National Cancer Institute, Egypt.

- Cells for breast (MCF7), colon (HCT), larynx (HEP2) or liver (HEPG2) cancer were plated in 96-multiwell plate (10^4cells/well) for 24 hours before treatment with the tested oils to allow attachment of cell to the wall of the plate. Different concentrations of the oils under test (0, 1, 2.5, 5 and 10μg/ml) were added to the cell monolayer. IC_{50} (dose of the tested oil which reduces survival rate to 50%) were

evaluated. Material that caused less than 50% survival was considered as anticancer agent for the organ it was tested for.

Statistical analysis

The collected data of biological examination were statistically analyzed. Analysis of variance was performed by ANOVA procedures. Significant differences between means were determined by Duncan's Multiple Range test.

RESULTS AND DISCUSSION

*Balanites aegyptiaca (L.) Del (*Zygopyllaceae) is a widely grown desert plant with multi use potential. It is found in the most of the Africa continent, the Middle East, and South Asia, however, this plant remains one of the most neglected plant species. Its seed kernel is used for oil extraction **Nkafamiya et al (2007)**.

Nutrient values of Balanites aegyptiaca kernel and pulp.

The nutrient status of BA fruits (kernel and pulp) is presented in Table 1. The results revealed that the oil and protein content of the kernel were high it were 47 and 37.48%, respectively. On the other hand carbohydrates content was found in low content 3.21%. However, the carbohydrates content in the pulp was the major constituents 63.81% and the percent of oil was neglected 0.27%. Our results for oil content was higher than results reported for Nigerian BA (38 %) **Nkafamiya *et al* (2007)**, Africa (44.17%) and India (39.20%) Balanites aegyptiaca **Chapagain and Wiesman (2005)** and somewhat similar with the findings for sunflower (45.6%) and Peanut (47.5%) **Axtell and Fairman (1992)**. The high proteien content (37.48%) is comparable with the results given for sesame (18.7%), cotton seed (21.9%) and peanut (28%) **Albrech (2003).** The high oil and protein content of kernel reflect high food energy and can be used to supplement the daily intake of the consumer also; they may be adequate for the formulation of animal feed **El-Khindar et al (1983) and, Axtell and Fairman (1992).**

Table (1) Proximate analysis of *Balanites aegyptiaca* kernel and pulp

Constituent	Kernel	Pulp
Moisture	4.36	17.63
Crude protein (Nx6.25)	37.48	4.43
Fat content	47.00	0.27
Crude fiber	3.65	6.24
Ash	3.91	7.62
Total carbohydrates*	3.21	63.81

Results were calculated on dry weight basis.
* Total carbohydrates were calculated by difference.

Amino acid composition of *Balanites aegyptiaca* kernel

The amino acids profile of defatted kernel were identified and the obtained results in Fig 1 showed that glutamic (5.94%) and argenine (4.13%) were the major amino acids followed by aspartic (2.77%) and leucine (1.70%) , whereas , alanine, proline, glyceine, valine and phenylalanine were found in almost the same percent.

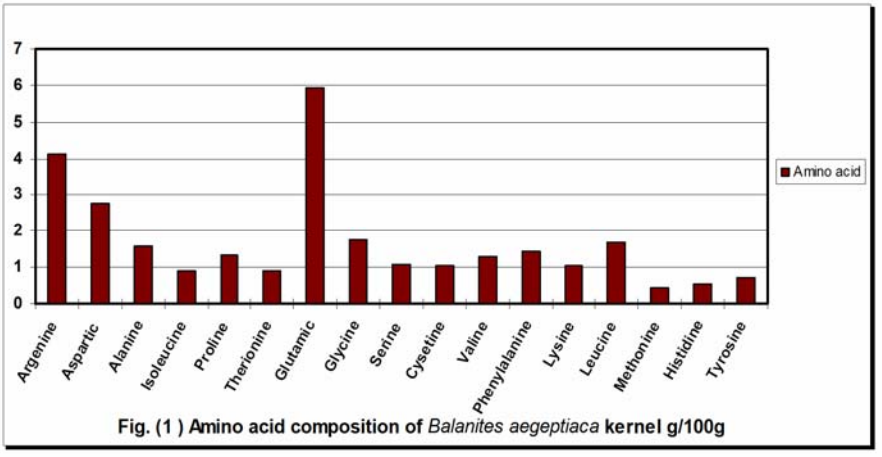

Fig. (1) Amino acid composition of *Balanites aegeptiaca* kernel g/100g

Mineral composition of *Balanites aegyptiaca* fruits

The mineral composition of the BA fruits (kernel and pulp) is listed in Table 2. The kernel and pulp contains several elements. Potassium and magnesium represent the major elements in the kernel 325.15 and 162.57 mg/100g, respectively. While potassium and

sodium were considered the major constituents for pulp (987.59 and 133.05 mg/100g). Our result value is higher than the obtained value for potassium (157 mg/100g) by **Nkafamiya et al (2007)** for Nigerian BA kernel. Moreover, Iron and zinc are among the essential elements for human and their daily requirements for adults are 15 and 18 mg, respectively **Kampali and Pali (2004)** though the level of iron and zinc are low in and kernel , they could contribute partially to the overall daily intake of iron, zinc and rich source of potassium and magnesium.

Table (2) Mineral content of *Balanites aegyptiaca* kernel and pulp (mg/100g).

Element	Kernel	Pulp
Na	46.73	133.05
Mg	162.57	75.84
K	325.15	987.59
Zn	3.37	1.11
Mn	1.08	0.32
Ca	11.24	5.50
Fe	7.81	5.85
Cu	2.33	Nd

nd: Not detected

Phenols content of Balanites aegyptiaca pulp and kernel

HPLC technique was employed to determine phenolic compounds in BA kernel and pulp. The results in Fig. 2 indicated that the fruit pulp was contained remarkable amounts of caffeic, cinnamic, catachein and vanillic acids , however, the main phenolic compounds in the kernel were vanillic, cinnamic and chrisin acids. Oilseeds generally contain phenolic compounds of various chemical natures including flavonoides, lignans, phenolic acids, tannins, and tocopherols. phenolic type compounds are the most widely reported antioxidative compounds of oil seeds , probably due to their presence in mature seeds. Phenolic acids can act as free radical acceptors and chain breakers, thus serving as efficient antioxidants in biological systems **Wanasundara et al (1997)**.

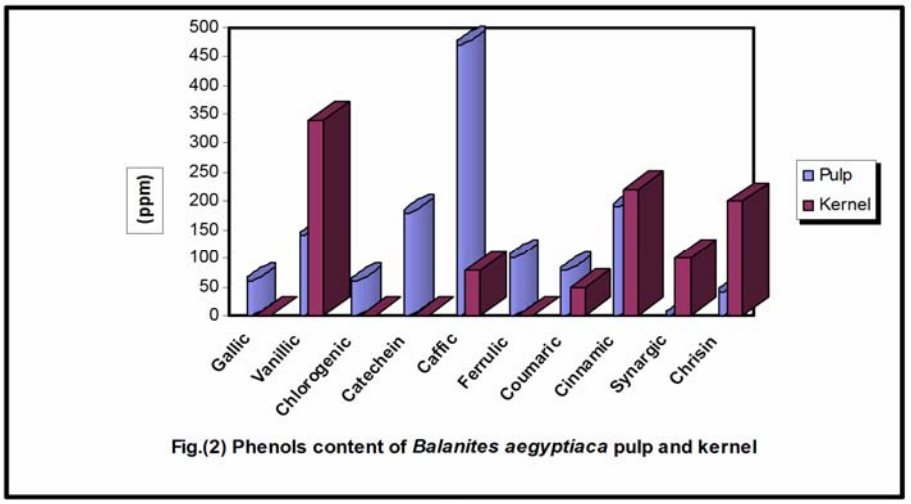

Fig.(2) Phenols content of *Balanites aegyptiaca* pulp and kernel

Physicochemical characteristics of *Balanites aegyptiaca* kernel oil

The oil extracted from the kernel was liquid at room temperature and has golden color with nutty flavor**.** The refractive index at 25°C, specific gravity at 20°C, color, acid, peroxide, iodine values, saponification value, unsaponifible matter and oxidative stability by Rancimat at 100°C in hr. were determined for the investigated kernel oil and results are shown in Table 3.

Results in Table 3 revealed that BA kernel oil had a refractive index of 1.4699 this results within the results of some oils such as grape seed oil (1.467-1.477), mustard seed oil (1.461-1.469) and sesame seed oil (1.465-1.469) **Codex Alimentarious (2005)**, specific gravity 0.9507, free fatty acid percent (as oleic acid) of 0.14, while it had a peroxide value of 3.6 (meq/kg oil). The low acid and peroxide value indicate the freshness of oil and that the oil may have long shelf live **Passera (1981)**. The color was found to be 1.5 R at 35 yellow. The iodine value (g/100g oil, Hanus) was found to be 95.09, which indicates that the oil was belonged to the non-drying oil category and it has high content of unsaturated fatty acid (74.42%). However the iodine value of oil is comparable with those of ground nut (84-99), olive oil (79-90) and castor oil (81-91) The saponification value was high (196) , the SV is thus within the range some edible oil such as palm oil (190-209), and cottonseed oil (189-198) ground nut oil (187-196) **Codex Alimentarious (2005)**. Hence judging by IV and SV values the oil may be suitable for soap and cosmetic making or

pharmaceutical purposes. The unsaponifaible matter percent was 1.5% and the oxidative stability was 14.1 hr at 100C which, reflect the high stability of oil, this could be attributed to the high content of saturated fatty acids (25.86%) the , polyphenol content in the kernel (1.45 %) and unsaponifaible matter which, include pigments, sterol, and vitamins.

Table (3) Physicochemical characteristics of *Balanites aegyptiaca* kernel oil

Parameters	Value
Refractive index at 20°C	1.4699
Specific gravity at 20°C	0.9204
Color at 35 Yellow	1.5R
Acidity (as % oleic acid)	0.14
Peroxide value (meq/kg oil)	3.60
Iodine value (g/100g oil, Hanus)	95.09
Saponification value mg (KOH/g oil)	196.00
Unsaponifiable matter (%)	1.50
* Oxidative stability (hours) at 100° C	14.1
Polyphenol extract yield for kernel	1.45
Polyphenol extract yield for pulp	1.21
Fatty acids profile	
C14:0	0.07
C16:0	14
C17:0	0.12
C17:1	0.06
C18:0	10.85
C18:1	33.15
C18:2	40.65
C18:3	0.16
C20:0	0.64
C20:1	0.30
TSFA	25.86
TUSFA	74.42
TUSFA/TSFA	2.89

*Rancimat Method TSFA: Total Saturated fatty acid TUSFA: Total Unsaturated fatty acid

Table 3 Also shows the relative percent of the identified fatty acids profile of BA kernel oil. The tabulated data in Table 3 indicted that linoleic acid was the predominant unsaturated fatty acid (40.65%). Meanwhile, palmitic acid was the major saturated fatty acid in the investigated oil (14 %) followed by stearic acid (10.85%). Moreover, oleic acid which considers monounsaturated fatty acid was found to represent 33.15 % while, linolenic acid, C18:3 were found in a low amount (0.16%).

Results also revealed that, the TSFA and TUSFA were 25.86 and 74.32, respectively and the ratio of USFA / SFA was 2.89: 1. The results for linoleic and palmitic acids found to be within the range of some oils ground nut, maize oil and sesameseed oil **Codex Alimintarious (2005)** These results are in adverse with **Abdel-Rahim and El-Saadany (1986)** who found that lauric acid (13.98%) and C:13 (10.87%) were the major saturated fatty acid and pentadecenoic C15:1 was the major unsaturated fatty acid (20.72%).The increase of unsaturated fatty acids content in the kernel oils of BA may reflect the hypochloesterolemic effect of the fruits as well as its role in atherosclerosis.

Unsaponifiable matter composition of Balanites aegyptiaca kernel oil

Unsaponifiable matter content of BA *kernel oil* was 1.5 % and the unsaponifiable matter fractions were identified by using GLC and the data in Table (4) are shown that 95.54% identified fractions of total unsaponifiable matter were composed of 64.10 % hydrocarbons and 35.90 % sterols , C_{20} compound was the major identified hydrocarbons (37.20 %) followed by C_{18} (16.26 %) , C_{12} and C_{21}.

β-sitosterol was the major identified sterol fractions and it amounted to 21.53 % followed by campesterol (6.42%), Δ5-avenasterol (3.22 %) and Stigmasterol was found in trace amount (0.07 %). Cholesterol was also detected in minor amount as shown in Table (4). **Abdel-Rahim and EL-Saadany (1986)** found that, the unsaponifiable content was higher than our results (2.1%) for BA kernel oil and campesterol was the predominant sterol fraction 8.08% while, C_{17} and C_{23} were the major hydrocarbons.

Table (4) Unsaponifiable matter fractions of *Balanites aegyptiaca* kernel oil

Compound	(%)
C 12	2.98
C 14	0.94
C 15	0.29
C 17	1.37
C 18	16.26
C 19	1.76
C 20	37.20
C 21	2.02
C 22	0.27
Squalene	0.90
Chlosterol	0.2
Campesterol	6.24
Stigmasterol	0.07
β-sitosterol	21.53
Δ5-avenasterol	3.22
Unknown-1	4.46
Total hydrocarbons	64.10
Total sterols	35.90

Effect of *Balanites aegyptiaca* oil on lipid profile

As shown in Table 5, the serum cholesterol levels of rats fed the BA diets were lower than that in rats feed control diet after 3 and 6 weeks. In addition the changes in TG levels are differed between the BA group and control group (Table 5). In the BA group concentrations significantly decreased after 6 week, whereas there was a non significant decrease in TG level compared with control group.

HDL-cholesterol levels were significantly increased in BA group as compared to the control group after 3 and 6 weeks (Table 5). So it was concluded that BA decrease the cholesterol

and TG levels whereas it was increase the level of HDL-cholesterol.

Table (5) Effect of dietary of *Balanites aegyptiaca* oil on cholesterol, triglycerides, HDL-cholesterol and total lipid concentrations of rats

Group / Period (Week)		Cholesterol (mg/dL)	Triglycerides (mg/dL)	HDL-cholesterol (mg/dL)	Total lipid (mg/dL)
Control	3	91.26 + 3.61[a]	175.93 ± 7.94[a]	81.76 ± 4.45[b]	293.2 ± 4.45[a]
	6	91.29 + 3.61[a]	175.95 ± 7.94[a]	81.74 ± 4.45[b]	293.2 ± 4.45[a]
BA	3	88.30 ± 7.90[a]	175.00 ± 5.00[a]	86.3 ± 11.30[a]	303.46 ± 11.30[a]
	6	86.80 ± 5.54[a]	98.83 ± 7.26[b]	108.24 ± 5[a]	300.00 ± 5.00[a]

Values are expressed as means±SEM; Values on the same column not sharing the same superscript letters were significantly different (P<0.05), n=6 rats

As shown in Table 6, and 7, it was concluded that the supplementations of BA had no significant effect on liver and kidney function. So, it was concluded that the supplementations of *Balanites aegyptiaca* kernel oil had no significant effect on blood lipid profile or liver and kidney function.

Table (6) Effect of dietary *Balanites aegyptiaca* oil on AST, ALT and ALP concentrations of rats

Group / Period (Week)		AST U/ml	ALT U/ml	ALP U/L
Control	3	37.66± 2.08[a]	37.33 ± 1.15[a]	259.30 ± 7.89[a]
	6	37.34 ± 2.08[a]	37.40 ± 1.15[a]	259.33 ± 7.89[a]
BA	3	42.0 ± 4.00[a]	37.0 ± 1.00[a]	246.66 ± 2.88[a]
	6	37.0 ± 1.00[a]	35.33 ± 2.30[a]	248.2 ± 5.01[a]

Values are expressed as means±SEM; Values on the same column not sharing the same superscript letters were significantly different (P< 0.05), n=6 rats

Table (7) Effect of dietary *Balanites aegyptiaca* oil on urea and creatinine concentration of rats

Group / Period (Week)		Urea mg/dL	Creatinine mg/dL
Control	3	32.80 ± 6.16[a]	0.59 ± 0.04[a]
	6	32.70 ± 6.16[a]	0.60 ± 0.04[a]
BA	3	34.25 ± 0.80 [a]	0.59 ± 0.01[a]
	6	28.69 ± 4.51[a]	0.56 ± 0.05[a]

Values are expressed as means±SEM; Values on the same column not sharing the same superscript letters were significantly different (P<0.05), n=6 rat

Cytotoxicity

Balanites aegyptiaca kernel oil was evaluated in National Cancer Institute Egypt for its cytotoxicity activity in in-vitro disease oriented antitumor screening using sulphorhodamine B (SRB) assay including 4 human tumor cell lines representing different cancer types (breast, Larynx ,liver and colon). The results in revealed that Balanites aegyptiaca kernel oil have no cytotoxic effect against the 4 tested human tumor cells under our experimental conditions. That may attributed to the high unsaturated fatty acids content, consequently a high susceptible to free-radical peroxidation. This means that higher cell-damaging free radicals are formed. **Eid et al (2009)** found that linseed oil exhibited an efficient cytotoxicity effect against breast, larynx and liver human tumor cell lines .One the other hand, marine algae and evening primrose oils have no any effect against these human tumor cell lines.

Conclusion

*Balanites aegyptiaca (L.) Del (*Zygopyllaceae) is a widely grown desert plant with multi use potential. It is found in the most of the Africa continent. In Egypt it found in El-Kharga and El-Dakhla Oasis in Eastern desert and Southern Aswan. This plant remains one of the most neglected plant species. The results have been proving that, the kernel had high content of protein and safe, good quality edible oil, the pulp contain carbohydrates. The oil and protein content in the kernel could be exploited as a new source of oil to support in partially

overcome the big gap in oil production in Egypt or exploited as nutritional supplement for malnutrition status and for children, pregnant women and elder people who need high energy diet for sustenance or could be used in formulation for animal feed.

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تقيم ثمار الهجليج *(Balanites aegyptiaca* L.) Del
كمصدر غير تقليدى للزيوت

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مركز البحوث الزراعية – معهد بحوث تكنولوجيا الأغذية- قسم بحوث الزيوت والدهون- مصر.

تمت دراسة التركيب الغذائى لثمار الهجليج (النوى واللب) وكذلك الخصائص الطبيعية والكيماوية للزيت المستخلص من النوى ودراسة تاثير الوجبة المدعمة بزيت النوى على ليبيدات الدم ووظائف الكلي والكبد لفئران التجارب كما تمت دراسة تاثير استخدام زيت النوى كمادة مقاومة لسرطان كلا من الثدى والمرئ والقاولون والكبد بطريقة سلفورودامين- ب . وقد اوضحت النتائج ان نوى الثمار يتميز بإحتوائه على نسبة مرتفعة من الزيت (47%) والبروتين (37.48%) والأملاح المعدنية ، وان الحامض الدهني السائد فى الزيت هو اللينوليك (40.60 %) بينما يعتبر مركب بيتاسيتوستيرول هو المركب السائد فى تركيب الأستيرولات (21.53%) فى حين يتميز اللب باحتوائه على نسبة مرتفعة من الكربوهيدرات (63.81%) . كما اظهرت النتائج انه حدث إنخفاض فى تركيزات الكوليستيرول الكلى بعد ٦ اسابيع من التغذية على الوجبة المدعمة بزيت نوى ثمار الهجليج فى حين ارتفعت مستويات الكوليستيرول عالى الكثافة بعد ٣ و ٦ اسابيع من التغذية مقارنة بمجموعة الكنترول . كما لوحظ ايضا انه لا يوجد تاثير معنوى على ليبيدات الدم او وظائف الكبد والكلي عند التغذية على الوجبة المدعمة بزيت نوى ثمار الهجليج.