

Evaluation of phytoconstituent of *Balanites aegyptiaca* (L) del leaves and fruit-mesocarp extracts

Abstract

Balanites aegyptiaca (L) Del is a medicinal plant used in several folk medicines and as food condiment etc in Africa. Therapeutic properties of medicinal plants depend on the varieties of chemical substances possess. This study aimed at investigating chemicals profile of *Balanites aegyptiaca* (L) Del extract. Defatted dried powdered *Balanites aegyptiaca* (L) Del leaves and fruit-mesocarp were extracted with ethanol followed by petition with ethyl acetate and water (1:1 v/v) then separated. Aqueous fractions obtained were subjected to column fractionation where methanol subfractions were analysis by GC-MS. Results of the study showed that extracts of *Balanites aegyptiaca* (L) Del leaves and fruit-mesocarp contained various phytochemical compounds. Among the phytochemicals identified were aliphatic alcohols, fatty acids and phenolic compounds. The study observed chemicals (phenolics) in the plant's parts are unequally concentrated; the leaves has more phenolics than the fruit-mesocarp. In conclusion, the study showed phenolic compounds and fatty acids are the most abundant in the plant parts which might probably accounted for the vast medicinal properties and the nutritional values.

Keywords: evaluation, phytoconstituent, *Balanites aegyptiaca* (L) del, leaves, fruit-mesocarp, extracts

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Introduction

Balanites aegyptiaca (L) Del is a medicinal plant used in several folk medicines and as food condiment etc Africa.¹ Medicinal plants contain large varieties of chemical substances which possess important therapeutic properties that can be utilized in the treatment of human diseases.² There are several reports in the literature regarding the chemical components of extracts prepared from plants which may be useful to humans.

Balanites aegyptiaca (L) Del (Zygophyllaceae), also known as 'desert date' in English, is a plant that grows in Sahel-Savanna regions and drier parts of middle-belt zones of Nigeria. It grows to 6 to 10 m in height, is highly resistant to stresses such as sandstorms and heat waves, and grows with minimal available moisture. It is found in all parts of the country but mostly in the Northern region. It is known as 'Aduwa' in Hausa, 'Utazi' in Igbo, and 'Teji' in Yoruba. *Balanites aegyptiaca* (L) Del has a long history of traditional uses for wide ranges of disease.³ Anti-diabetic activity of *Balanites aegyptiaca* (L) Del extracts have been reported in both diabetic mice and rats.^{4,5,6,7} Al-Malki et al.⁸ have reported antioxidant potential of *Balanites aegyptiaca* (L) Del in combating disease. Studies have also reported that *Balanites aegyptiaca* (L) Del have been used as folk medicine in many regions of Africa and Asia.^{1,9,10} Literature have reported antifeedant, molluscicide, anthelmintic, and contraceptive activities of *Balanites aegyptiaca* (L) Del extracts.^{11,12}

Phytochemical investigation of *Balanites aegyptiaca* (L) Del parts revealed the presence of some important chemical compounds like polyphenols; coumarins and quercetins in the leaves, alkaloids and coumarins were seen in the stem-bark while rutins was found in the fruit among others.^{13,14} Information on variety of chemical constituent of *Balanites aegyptiaca* (L) Del parts are insufficient. Hence, this study investigated chemical constituents of *Balanites aegyptiaca* leaves and fruit-mesocarp for the purpose of nutritional and pharmaceutical

utilizations. Our study showed phenolic compounds like *eugenol*, *transisoeugenol* etc and fatty acids (oleic acid) are abundant in the plant particularly the leaves and this may accounted for vast medicinal properties and nutritional values of the plant.

Materials and methods

Chemicals/Reagents

All chemicals/reagents used were of analytical grade and were obtained from Sigma Aldrich, USA.

Plant collection

Balanites aegyptiaca (L) Del Leaves were collected from Gubi village (latitude 10°45' N & longitude 9°82' E) in Bauchi, Bauchi state. It was identified and authenticated by Mr. Namach Sunusi of the Herbarium Unit, Department of Biological Science, Ahmadu Bello University Zaria. A voucher specimen (voucher no: 900175) was deposited in the herbarium of the Department.

Plant extraction/fractionation

Plant sample defatting and extraction was performed as done by Jung et al.¹⁵ and Govorko et al.¹⁶ with modification in choice of the extraction temperature (60°C). Seven hundred and fifty gram (750g) powdered of each plant part was defatted for 2hours with 1200ml hexane on mechanical shaker. The hexane solvent was discarded, and the defatted samples were air-dried then exactly 200g each of the defatted plant leaves and fruit-mesocarp were mixed with 2000ml of 80% ethanol and heated to 60°C for 2hours. The extraction was continued for an additional 10hour at 20°C. The mixture was filtered through a cheese cloth and resulting ethanol extract was air-dried. The procedure was repeated twice with same amount of defatted plant leaves and fruit-mesocarp. The ethanol extract of the leaves and fruit-mesocarp obtained were dissolved in water (500ml) and partitioned

with ethyl acetate (500ml) at 20°C for 2 hours then separated using a separating funnel (1000ml). Each fraction was concentrated using a rotary evaporator at 40°C and air dried. The dried extract-fractions of various parts of *Balanites aegyptiaca* were stored in air-tight containers and kept in a refrigerator at 4°C until used.

Gas chromatograph-mass spectrometry analysis

Analysis of *Balanites aegyptiaca* (L) Del extract was carried out by using a Shimadzu GC-MS equipped with silica type DB1 capillary column (30m×0.25mm i.d.), film thickness 0.1µm. The temperature of injector was 300°C and the oven temperature was 300°C. Helium (99.9%) was used as the carrier gas at a flow rate of 0.90mL/min. Samples of 2µL of *Balanites aegyptiaca* (L) Del were injected.

Table 1 Phytochemicals identified in methanol subfraction derived from ethanol aqueous-fraction of *Balanites aegyptiaca* leaves by GC-MS analysis (matching library of ≥80 %)

Peaks	Retention time (Min)	Peak area in %	Name of compound	Aqual factor
Aliphatic aldehydes				
36	13.929	1.37	7-hexadecenal	95
37	16.364	3.08	9-octadecenal	95
61	24.538	0.81	2-hydroxy-9,17-octadecenial	94
Fatty acids				
64	20.927	7.27	hexadecenoic acid	80
66	22.463	8.67	oleic acid	86
68	22.774	5.52	11-octadecenoic acid	99
74	24.666	9.82	glycidyl palmitate	95
Phenolic compounds				
27	13.385	0.04	2-methoxy-4-vinylphenol	95
29	13.922	0.12	2,6-dimethoxyphenol	83
30	14.003	0.2	2-methoxy-3-(2-propenyl)-phenol	98
35	15.362	0.12	2-methoxy-4-(1-propenyl)-phenol	90
Others				
6	3.253	0.43	pyridine	83
19	8.576	0.14	benzyl alcohol	97
26	11.433	0.05	methyl salicylate	95
46	16.375	0.57	3-eicosene	91
48	16.741	0.16	2-methyl-Z,Z, 13-octadecadienol	90
49	16.91	0.6	2-methyl-2,5-dimethoxybenzaldehyde	80
50	17.134	0.05	cyclopropaneoctanal, 2-octyl	97

Results and discussion

Gas chromatograph-mass spectrometry analysis

Figure 1 show result of the GC-MS chromatogram of *Balanites aegyptiaca* (L) Del leaves extract. The components in the extract were detected at the retention time in the range from 1-26min. The total components detected were 78 types. Table 1 shows basic components in the extract of the plant's leaves; 3 aliphatic aldehyde, 4 fatty acids, 4 phenolic compounds and others. Figure 2 shows result of the GC-MS chromatogram of *Balanites aegyptiaca* (L) Del fruit-mesocarp extract. The components in the extract were detected at the retention time in the range from 1-26min. The total components detected were 37types. Table 2 shows basic components in the extract of the plant's fruit-mesocarp; 4 aliphatic alcohols, 5 fatty acids and a phenolic compound.

Table 2 Phytochemicals identified in methanol subfraction derived from ethanol aqueous-fraction of *Balanites aegyptiaca* Fruit-mesocarp by GC-MS analysis

Peaks	Retention time (Min)	Peak area in %	Name of compound	Aqual factor
Aliphatic alcohols				
7	7.799	0.05	2-nitro-tertiary butanol	38
17	20.269	1.89	2-octanol	35
26	23.562	13.12	2-hexanol	14
28	23.852	1.32	4-ethyl-3-octanol	38
Fatty acids				
1	0.501	0.05	11,14-eicosadienoic acid	46
10	17.232	0.12	9,12-octadecadienoic acid	95
12	15	0.7	9-octadecadienoic acid	70
13	18.668	0.23	oleic acid	53
32	24.046	5	glycidyl palmitate	95
Phenolic compound				
8	13.385	0.04	2-methoxyl-4-vinylphenol	91

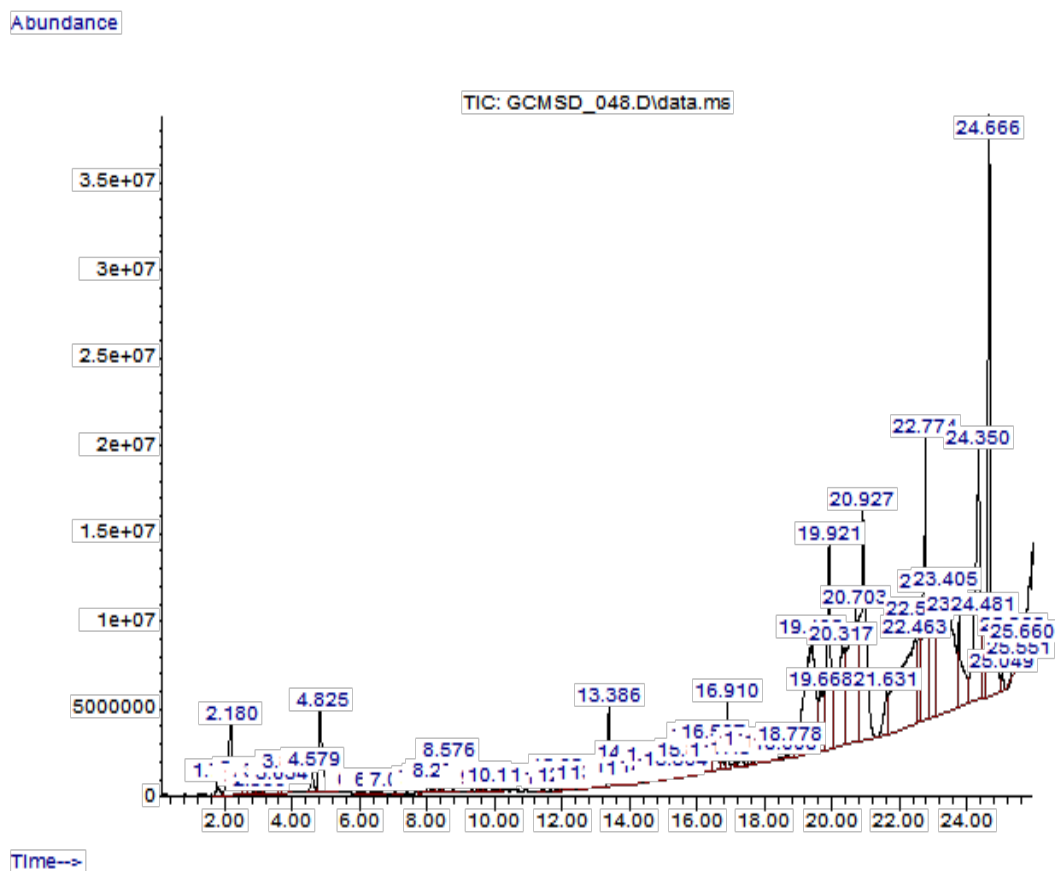


Figure 1 GC-MS chromatogram of methanol fraction derived from ethanol aqueous-fraction of *balanites aegyptiaca* Leaves.

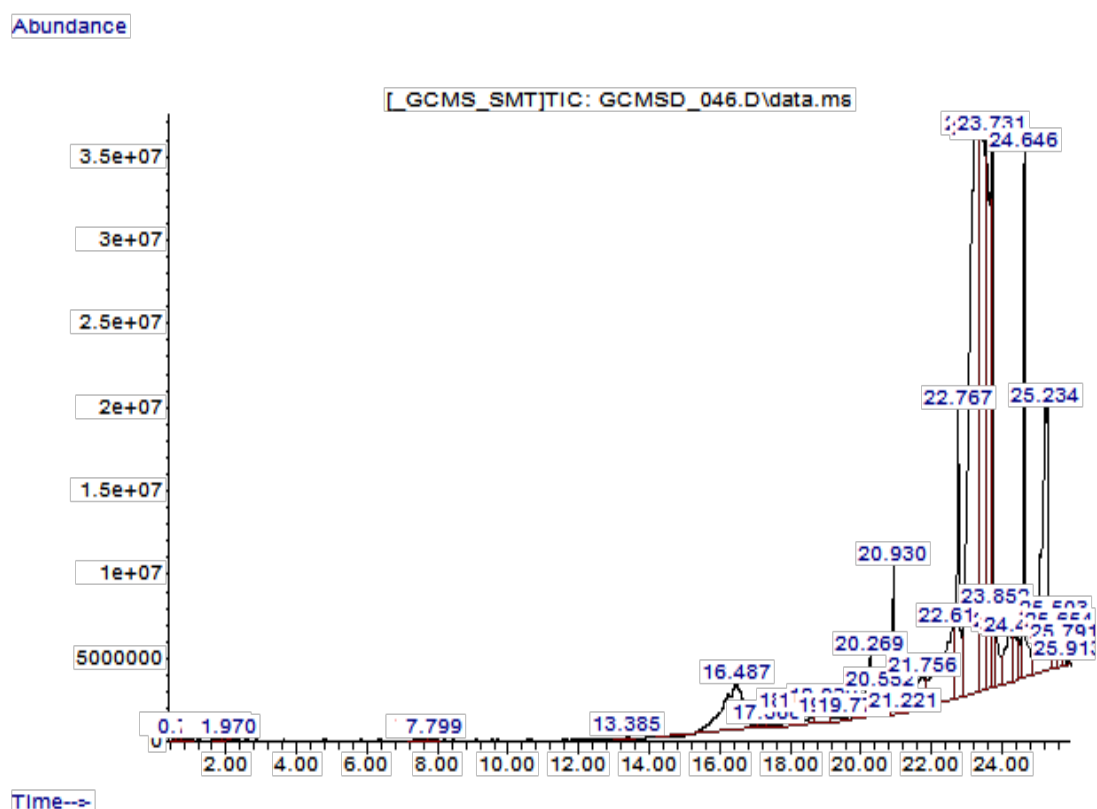


Figure 2 GC-MS chromatogram of methanol subfraction derived from ethanolic aqueous-fraction of *balanites aegyptiaca* fruit-mesocarp.

Among the identified compounds, phenolics have been reported to account for various pharmacological or biological activities. It was reported that phenolic compounds exert antioxidant, antidiabetic, anticancer etc.^{15,16,17,18} Eugenol and isoeugenol, phenolic compounds identified from *Balanites aegyptiaca* (L) Del's extracts in our study have been reported to exert antidiabetic activity among other pharmacological roles.^{19,20} Based on this, one may suggest that the phenolic compounds identified from *Balanites aegyptiaca* (L) Del account for its vast medicinal properties particularly antidiabetic activity. Eugenol and isoeugenol as well as other phenolics were for the first time being identified in *Balanites aegyptiaca* (L) Del leaves extract. Al-Malki et al.²¹ have identified 2 phenolic (vanillic and syringic) from *Balanites aegyptiaca* fruit extract.

Conclusion

The study specified that extracts of *Balanites aegyptiaca* (L) Del leaves and fruit-mesocarp contained various phytochemical compounds. It showed that the phytochemicals were unequally concentrated in the plant's parts. Phenolic compounds like eugenol, isoeugenol etc were noticed to be concentrated in the plant's leaves while fatty acid like oleic acid was in both plant parts. Presence of these phytochemical may account for the vast medicinal and nutritional properties of *Balanites aegyptiaca* Del.

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Conflict of interest

The author declares no conflict of interest.

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