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Chemical investigation of *Adansonia digitata* L. seed oil produced in Western Sudan

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Abstract

The chemical compositions of seed oil obtained from *Adansonia digitata*, L. (Bombacaceae) Sudanese variety were analyzed by Gas Chromatography-Mass spectrometry. The Thirty three constituents were identified. The major constituents were cyclopentanetridecanoic methyl ester (31.48%), hexadecanoic acid (Palmitic), methyl ester (25.44%), 8,11-octadecadienoic , methyl ester (21.95%),9,12-octadecadienoic (Lindeic) , methyl ester (6.15%) and 10-nonadecanoic, methyl ester (4.20%). The present study revealed that the seed oil of *A. digitata* rich in fatty acids (72.72%). Seeds of this plant species may be explored for manufacturing industrial and pharmaceutical products.

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Introduction

Continuing our investigations on chemistry of fixed oils from plant seeds used in Sudanese Traditional Medicine (Mustafa and EL-Kamali, 2016), we have analyzed the fixed oil of *Adansonia digitata* to determine their potential as a source of fatty acids for culinary cosmetical, medicinal dietics and or pharmaceutical exploitation.

Adansonia digitata L., a tree plant belonging to the Bombacaceae family, is widespread throughout the hot, drier regions of Tropical Africa.

The fruit shell contains numerous hard, brownish seeds, round or ovoid, up to 15 mm long, which are embedded in a yellowish-white , flouring acidic pulp 2-3.

The seed oil is used by the Sudanese local people in Western regions to treat stomachache and also used to massage on the body to relieve tired bodies.

Oil extracted from seeds is used for inflamed gums and to ease diseased teeth, as an emollient and is skin soothing and help skin retain its elasticity (Sidibe and Williams, 2002).

Seeds are used in Africa as a thickening agent in soups, but they can be fermented and used as flavouring agent or roasted and eaten as snacks (Addy and Eteshola, 1984). *A. digitata* seeds have shown antiviral activity against influenza virus, herpes simplex virus and respiratory syncytial virus (Vimalanathan and Hudson, 2009).

According to Wickens (1979) seeds contain the alkaloid "adansonin" which has a Strophanthus like action. Previous studies determined the chemical profile of seed oil of *A. digitata* using GC/MS.

They observed the presence of oleic and linoleic as major unsaturated fatty acids and palmitic as major saturated acid (Osman, 2004).

The aim of the current study is to evaluate qualitatively and quantitatively *Adansonia digitata* seed oil for their chemical composition.

Materials and methods

Plant material

Seed oil of *Adansonia digitata* was purchased from EL-Obeid local market, Western Sudan in 2012.

Preparation of oil sample for GC Analysis

Fatty acids present in baobab were extracted by incubating the oil in NaOH-methanol at 70 °C for 2 hours. Free fatty acids were converted to fatty acid methyl esters for GC analysis equipped with MS (Shimatzo QP 2010 GC/MS Instrument equipped with reference libraries).

Packed material for column were 50% phenyl and 50% methyl polysiloscane, column length 30 meter, diameter 0.025 mm, the flow rate of helium as carrying gas was 1 ml/min.

The temperature of program consisted of 60-270 C, at rate of 4 C/min. MS were taken at ionization voltage 70 EV. Library search was carried out using Wiley GC/MS library.

Identification of isolated compounds

The individual identifications were made by the comparison of fragmentation patterns with those found in the library of the mass spectrometer.

Results and discussion

Table 1 present the fatty acids and sterol/triterpenes profile for n-hexane extract of seed oil from *Adansonia digitat*. Thirty three constituents were identified.

The major constituents were cyclopentanetridecanoic methyl ester (31.48%), hexadecanoic acid (Palmitic), methyl ester (25.44%), 8,11-octadecadienoic, methyl ester (21.95%),9,12-octadecadienoic (Lindeic), methyl ester (6.15%) and 10-nonadecanoic, methyl ester (4.20%). Upon comparing the composition of Sudanese Baobab oil with that of other origins (Table 2), some variation was noted.

Table 1. Seed fixed oil composition of *Adansonia digitata*.

	Compound	Other chemical names	%
1	Eucalyptol	Cineole; 1,8-cineole; cajeputol	0.01
2	Camphor	2-camphanone; 2-bornanone; (+)-camphor	0.0001
3	Nonanoic acid	Pelargonic acid	0.02
4	8-nonanoic acid	-	0.02
5	10-undecanoic acid	Undecenoic acid; undecylenic acid; undec-10-enoic acid	0.01
6	Dodecanoic acid	Lauric acid	0.01
7	Butylatedhydroxytoluene	Dibutylhydroxytoluene	0.03
8	Tetradecanoate	Myristate	0.37
9	12-octadecadienoic acid	Linoleic acid	0.01
10	5-octadecenoic acid, methyl ester,Z	-	0.02
11	Pentadecanoic acid , methyl ester	Pentadecylic acid	0.08
12	Hexadecanoic acid	Palmitic acid	25.44
13	7,10-hexadecadienoic acid,methyl ester	Hexadeca-7,10-dienoic acid	0.04
14	10-hydroxydecanoic acid	Decanoic acid,10-hydroxy; 10-hydroxy-capric acid	0.97
15	Unidentified	-	0.53
16	9,12-octadecadienoic acid	Leinoleic acid ; lindeic acid	6.51
17	Cyclopentanetridecanoic acid, methyl ester	Methyl dihydrochaulmoograte	31.48
18	11-octadecenoic acid	-	0.64
19	8,11-octadecadienoic acid	-	21.95
20	9,12,15-octadecatrienoic acid,methyl ester	Methyl linolenate; Linolenicacid,methyl ester	0.64
21	Linoleic acid		2.50
22	10-nonadecenoic acid	-	4.20
23	Eicosanoic acid, methyl ester	Methyl eicosanoate; Arachidic acid, methyl ester	2.13
24	9,12-octadecdienoyl chloride	-	0.22
25	9-octadecenoic , 12- hydroxyl	-	0.02
26	Heneicosanoicacid, methyl ester	Methyl heneicosanoate	0.04
27	Oleic acid		0.05
28	Dodecanoic 9-decen	-	0.17
29	Docosanoicacid,methyl ester	Methyl docosanoate; Behenicacid,methyl ester	0.68
30	Tricosanoicacid,methyl ester	Methyl tricosanoate	0.14
31	Tetracosanoic acid, methyl ester	Methyl tetracosanoate; Lignocericacid,methyl ester	0.55
32	Pentacosanoic acid, methyl ester	Methyl pentacosanoate	0.09
33	Squalene	-	0.08
34	Gamma-sitosterol	Fucosterol	0.35

Table 2. Comparison of some constituents (%) of *A. digitata* from different origins.

Fatty acid profile	Osman (2004), Saudi Arabia	Gaydou *et al.*, (1979)	Ezeagu (2005), Nigeria	BFCS (2003), Senegal	Present study (Sudan)
Saturated					
C14:0 (Tetradecanoate)	0.2				0.37
C16:0 (Palmitic)	24.2	26.7	22.06	18-30	25.44
C18:0 (Stearic)	4.6			2-8	
C20:0 (Eicosanoate)	1.3				2.13
C22:0 (Docosanoate)	0.7				0.68
C24:0 (Tetracosanoate)	0.2				0.55
Monounsaturated					
C17:1	0.3				
C18:1 (Oleic)	35.8	41.9	34.97	30-40	0.05
C20:1					
Polyunsaturated					
C18:2 (Linoleic)	30.7	20.6	26.14	24-34	2.50
C18:3 (Linolenic)	1.0			0.5-3	

The chemical composition of Sudanese *A. digitata* oil was characterized by a present of cyclopentanetridecanoic acid (31.48%), 8,11-octadecadienoic acid (21.95%), 10-nonadecanoic acid (4.20%) and arachidic acid (2.13%). Seed oil of plant has been characterized by the occurrence of tetradecanoate, eicosanoate, docosanoate and tetracosanoate were found in Saudi Arabia variety,

whereas linolenicacd was found in the seed oil from Saudi Arabia and Senegal (Table 2).

Differences in fatty acids composition between different baobab seed oils could be explained by various factors including seed genetic variations oil processing differences (cold press extracted or solvent extracted) or different harvest dates.

Conclusion

In conclusion, the present study revealed that the seed oil of *A. digitata* growing in western Sudan rich in fatty acids (72.72%). Seeds of this plant species may be explored for extracting these fatty acids, most of which are used in manufacturing industrial and pharmaceutical products. The seed oil of *A. digitata* could be a new source of edible vegetable oil after the future toxicological studies.

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