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Characterization of Lipid Compounds of the Dried Fruits of *Xylopia aethiopica* (Dunal) A. Rich Growing in Sudan

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Abstract: Total lipids extracted from the seeds of *X. aethiopica* were found to be 10%. The oil was analyzed for fatty acids and sterols composition. Thirteen fatty acids were identified, with their methyl esters using GC/MS analytical method. The majority of fatty acids were unsaturated (72%). Oleic acid was the dominant unsaturated fatty acid (69.37%), while the saturated fatty acids represented about 27% of the total fatty acids present in oil from seeds, mainly palmatic acid (15.66%) and stearic acid (9.5 %). The sterols quantification and identification were preformed by analysis of the unsaponifiable matter of the seed oil using GC/MS technique. The level of sterols estimated in the oil was 4.2 g/kg oil. The main component was Sitosterol which represented about 58% of the total sterol content, followed by campesterol (23.5%) and Δ^5-Avenasterol (12.1%). Cholesterol was found at about 3% of total sterols.

Key words: *Xylopia aethiopica*, fixed oil, fatty acids, sterols

INTRODUCTION

Xylopia aethiopica (Annonaceae) is an ever green, aromatic tree, growing up to 20 m high. It is a native to the low land rain forests and moist fringe forests in the savanna zones and coastal regions of Africa (Dalziel, 1955; Irvine, 1961), largely located in west and central Africa, where it thrives in wet, swampy soils and in southern Africa (Hutchinson and Dalziel, 1955; Keita *et al*., 2003). In Sudan it is distributed in high rain fall Savanna and swampy forests (Elamin, 1990; Elgahazali *et al*., 2004). It is used under the name of Guinean pepper as spice and soup condiment and is valued for its carminative effect. It has been applied in ethnomedicine in Africa (Dalziel, 1955; Iwu, 1986; Oliver, 1986; Akendengue, 1992; Maurice, 1993; Mamoudoukande *et al*., 1994; Etkin, 1997; Suleiman *et al*., 2005).

MATERIALS AND METHODS

The dried fruits of *X. aethiopica,* were brought from a local market and authorized by Medicinal and Aromatic Plants Research Institute (MAPRI), Sudan.

Preparation of the oil: Total lipids were extracted from the seeds with petroleum ether (b.p.40-60°C) using Soxhlet apparatus. The solvent was evaporated on a rotary evaporator under reduced pressure and the produced oil was dried in an oven at 105°C to a constant weight (AOAC, 1990).

GC-MS Identification of fatty acids methyl esters: The fatty acids methyl esters were prepared as described in IUPAC (1964). They were identified using Gas Chromatography-mass Spectrometry Analysis (GC-MS), type HP 6890 (GC), HP 5973 (MSD).

Identification of sterols: In order to identify the sterols in oil sample under investigation, the unsaponifible matter was analyzed by gas chromatography-mass sepectrometry analysis (GC-MS).

Saponification of the oil: Five grams of the oil were dissolved in ethanol (30 mL), then 50 mL alcoholic KOH (50%) were added. The oil was saponified on a water bath for 30 min under reflux air condenser.

Isolation of unsaponifiable matter: The alcoholic solution was concentrated and quantitatively transferred into separatory funnel using a total of 50 mL distilled water and 50 mL petroleum ether. The unsaponifiable matter was extracted three times with petroleum ether, washed several times with distilled water, dried over anhydrous sodium sulphate and then filtered into a weighed flask. The solvent was evaporated using a boiling water bath and the flask was dried at 105°C until constant weight was reached.

GC-MS Identification of sterols: Gas chromatography-mass spectrometry was performed using a gas chromatograph-mass spectrograph (GC-MS) (TRACE GC 2000/FINNGAN MAT SSQ7000 MASSSPECTROMETER) fitted with electron impact (EI detector, 70 eV)) mode. The analytical column was DB-5 (5%-phenyl- methylpolysiloxane) with internal diameter (ID) 30 m X 0.25 X 0.25. Helium was used as a carrier gas at a flow rate of 1 mL/min. The temperature was programmed at 50°C for 5 min then increased to 300°C at the rate of 5°C/min. The temperature of injector was 250°C. The total run time was 53 min.

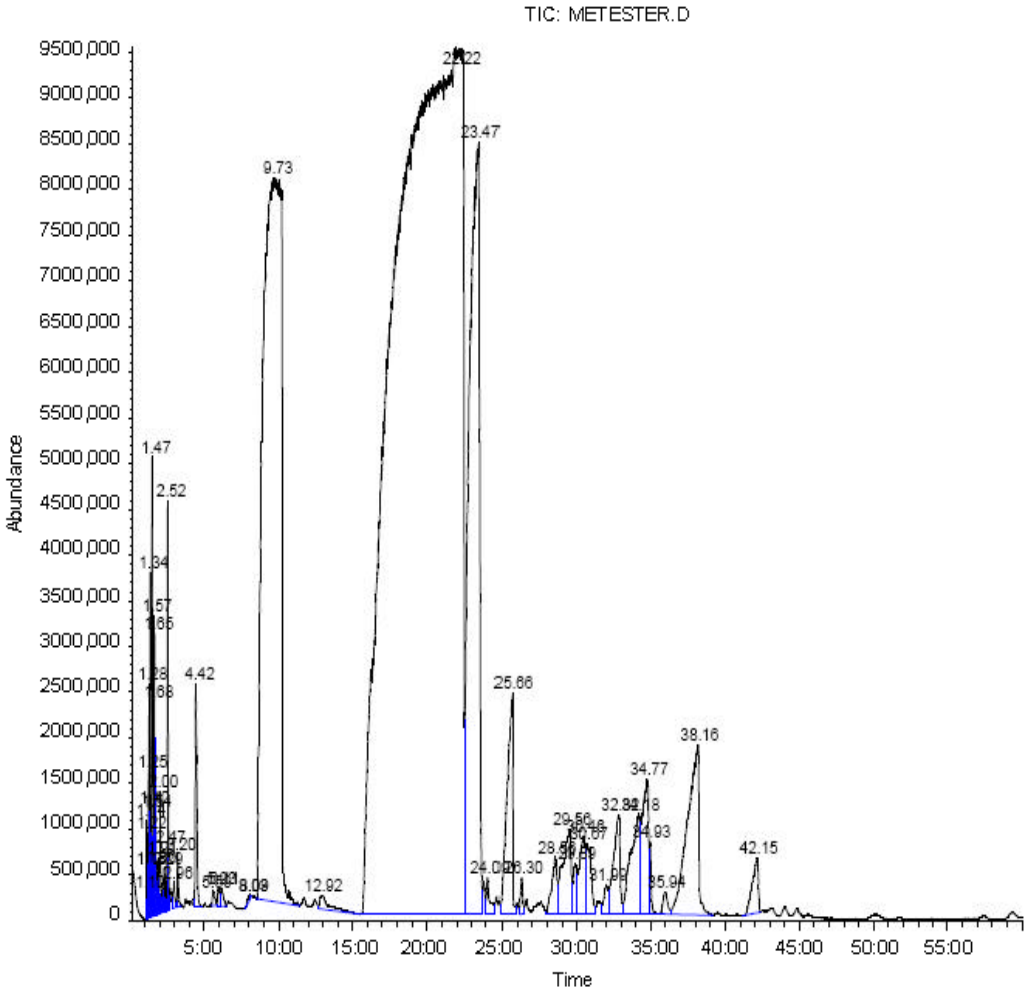

Fig. 1: Gas chromatogram of fatty acids methyl esters of *X. aethiopica* seeds oil

RESULTS

Thirteen fatty acids were identified, with their methyl esters, in the fixed oil of the fruit seeds of *X. aethiopica*. Their identification was established on the basis of chromatographic and mass spectral data. Figure 1 shows the gas chromatogram of the fatty acids methyl esters of *X. aethiopica* seeds oil, whereas the data about the qualitative and quantitative composition of fatty acids are summarized in (Table 1).

The main phytosterols identified in the oil of seeds of *X. aethiopica* were sitosterol, campesterol and Δ^5-Avenasterol. Cholesterol was found in small quantity among the total sterols. Figure 2 shows the gas chromatogram of the unsaponifiable matter of *X. aethiopica* seeds oil, whereas the data about the qualitative and quantitative of sterols composition are summarized in (Table 2).

Table 1: Fatty acids composition of *X. aethiopica* seed oil

Systematic name	Percentage
Saturated fatty acids	
Octanoic acid	00.36
Hexadecanoic acid	15.66
Heptadecanoic acid	00.33
Octadecanoic acid	09.47
Eicosanoic acid	00.59
Pentadecanoic acid	00.02
Tetradecanoic acid	00.60
Total	27.03
Unsaturated fatty acids with one double bond	
9-Hexadecenoic acid	00.20
9-octadecenoic acid	69.37
10-nonadecenoic acid	00.28
11-Eicosenoic acid	02.50
Total	72.35
Unsaturated fatty acids with two double bonds	
10, 13-Octadecadienoic acid	00.32
11, 14-Eicosadienoic acid	00.30
Total	00.62

DISCUSSION

Among the total lipids present in fixed oil of seeds of the *X. aethiopica* from Sudan, fatty acids profile evinces the lipids as a good source of essential fatty acids. Oleic acid (69.37%) was the dominating fatty acid, followed by

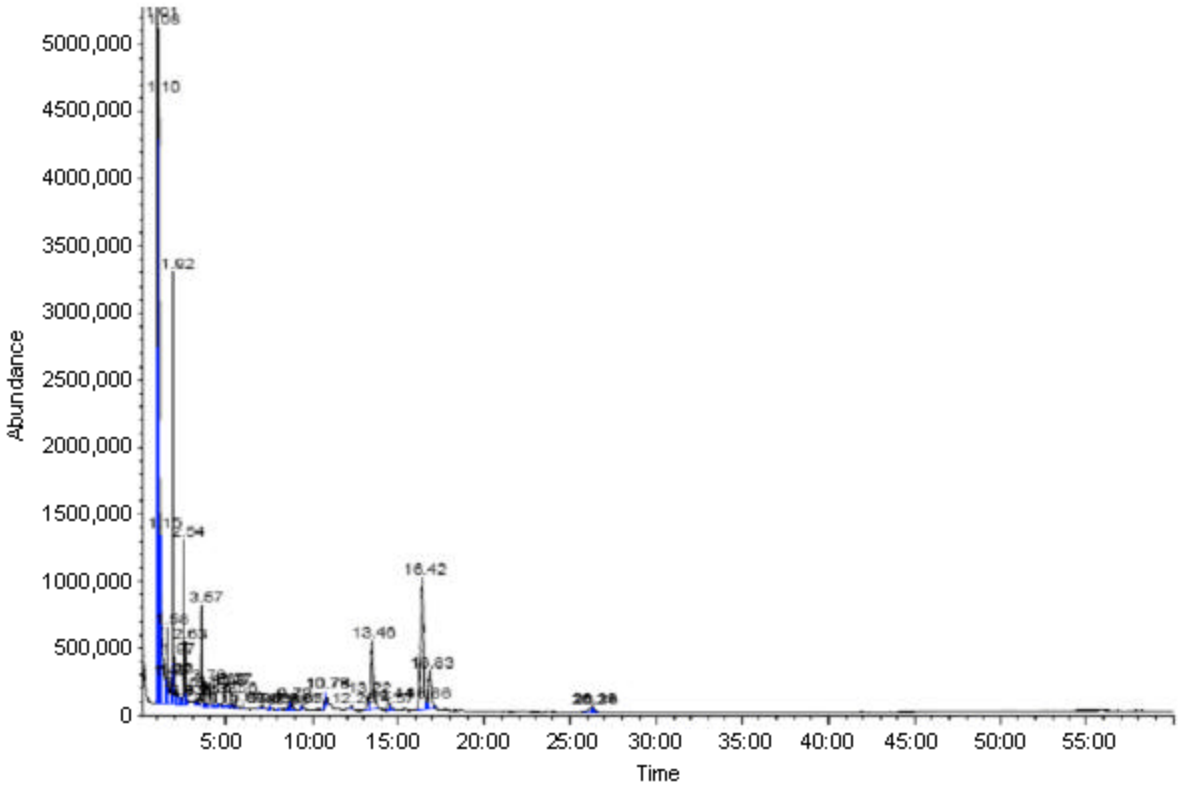

Fig. 2: Gas chromatogram of unsaponifiable matter of *X. aethiopica* seed oil

Table 2: Sterol composition of *X. aethiopica* seed oil

IUPAC name	Common name	Retention time (min)	Percentage
Cholest-5-ene-3 ß-ol	Cholesterol	10.78	03.20
Ergost-5,24-diene -3ß-ol	_____	13.22	03.30
Ergost-5-ene-3ß-ol	Campesterol	13.46	23.50
5α-Stigmast-5-ene-3ß-ol	Sitosterol	16.42	58.00
5α-Stigmasta-5,24(28)-diene 3ß-ol	Δ^5-Avenasterol	16.83	12.00

palmatic acid (15.66%) and stearic acid (9.47%). The majority of fatty acids were unsaturated fatty acids (72%), while the saturated fatty acids, mainly palmatic and stearic acids were about 27% of the total fatty acids present in fixed oil from seeds of the plant.

The fatty acids composition of oil from seeds of *X. aethiopica* from Sudan differ from fatty acids composition of oil from seeds of *X. aethiopica* from Nigeria (Barminas *et al*., 1999). Oleic acid is the predominant unsaturated fatty acid in the seeds oil of *X. aethiopica* from Sudan, whereas linoleic acid is the predominant unsaturated fatty acid in the seeds oil of *X. aethiopica* from Nigeria.

The level of sterols estimated in the oil was 4.2 g/kg oil. The main component was sitosterol which represented about 58% of the total sterol content, followed by campesterol (23.5%) and Δ^5-Avenasterol (12.0%). Cholesterol was found at about 3% of total sterols. Sterols content in the fruit seeds oil (4.2 g/kg) was similar to that in sunflower oil (4.3 g/kg); higher than that in extra virgin olive oil (having a median value of 1.5 g/kg) and soy oil (3.5 g/kg) and lower than those in crude corn oil (8.5 g/kg), rapeseed oil (8.2 g/kg). The amount of cholesterol in the fruit seed oil (ca. 0.014%) was very low compared to those in olive and soybean oils (ca.0.40%) and palm oil (2.30%) (Guderjan *et al*., 2005; Hafidi *et al*., 2005).

Conclusion: The lipid profile (fatty acids and sterols) of the seed oil of the fruits of *X. aethiopica* is a recent addition to the current literature available on the composition of the fruit of this important plant growing in several African countries.

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