



The Fatty Acid Profile of Oils from *Garcinia kola*, *Tetracarpodium conopodium* and *Tectona grandis*

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Authors' contributions

This work was carried out in collaboration among all authors. Author AMO designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors AA and BBA managed the analyses of the study. Author BBA managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The fatty acids in the oil of *Garcinia kola*, *Tetracarpodium conopodium* and *Tectona grandis* were determined using a Perkin Elmer Auto sampler XL gas chromatograph with FID detector and split injector operating at 220°C. The result showed that *Garcinia kola* contained saturated fatty acid (15.78%) monounsaturated fatty acid (33.29%) and polyunsaturated fatty acid (50.92%). *Tetracarpodium conopodium* contained saturated fatty acid (5.72%) monounsaturated fatty acid (77.31%) and polyunsaturated fatty acid (16.96%) *tectona grandis* contained saturated fatty acid (59.93%), monounsaturated fatty acid (24.08%) and polyunsaturated fatty acid 15.99%. The major fatty acid in *Garcinia kola* is oleic acid, while the major fatty acid in *Tetracarpodium conopodium* is paullinic acid and the major fatty acid in *Tectona grandis* is palmitic acid. In conclusion, the result of the fatty acid profile showed that *Tetracarpodium conopodium* and *Garcinia kola* contained high percentage of essential fatty acids while *Tectona grandis* also contained some essential fatty acids. Therefore the seeds oils may be useful in the food, beverages, fine chemical, oil and pharmaceutical industries.

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1. INTRODUCTION

Medicinal plant contains various substances that can be extracted and used in the various divisions of the chemical industries. *Garcinia kola* is a forest tree that is cultivated for its economic importance. It is widely distributed in the tropics especially west and Central Africa. *Tetracarpodium conopodium* (walnut) is a climbing shrub grown in Southern Nigeria and northern Cameroon. *Tectona grandis* (Teak) is one of the most famous timbers in the world and is renowned for its dimensional stability and extreme durability [1,2].

Nuts are considered nutrient dense foods and their consumption has been associated with reduced risk of coronary heart diseases. The health benefits of nuts are partially attributable to their high content of unsaturated fatty acid. For example, α -linolenic acid is an unsaturated fatty acid found in walnut, bitter kola and Teak seed oil. Fatty acids are carboxylic acids containing a hydrocarbon with a carboxyl group [3,4].

In this work, the fatty acid profile of oil extracted from teak seed oil, walnut and bitter kola are described and uses of the oils are suggested based on the composition of the oil [5,6].

2. MATERIALS AND METHODS

Tectona grandis were collected in the premises of Osun State Polytechnic, Iree. *Garcinia kola* were bought at Obada market Iree. Walnut were bought at Obada market Iree. All seeds were identified in the botany department, university of Ibadan. The seeds were then removed from their pods. The seeds were then air dried for about one week. The dried seeds were granulated into coarse particles using a laboratory grinder.

2.1 GC Condition for Analysis of Fatty Acid Profile

The fatty acids in the oil of *Garcinia kola*, *Tetracarpodium conopodium* and *Tectona grandis* were determined using a Perkin Elmer Auto sampler XL injector operating at 220°C. The column used was BPX – 70 – 02, 3.0 m, 0.25 mm and 0.25 μ m employing helium at a flow rate of 20 psi as carrier gas. The standards used were Kel-Fame 5 and GLC – 21A. The process was carried out by injection of 1 μ l of the raw

sample using a study period of 69.17 min, 70.80 min and 71.60 min for *Garcinia kola*, *Tetracarpodium conopodium* and *Tectona grandis* respectively. The sampling rate for all samples is 12.50 pts/s.

3. RESULTS AND DISCUSSION

3.1 Fatty Acid Composition

Table 1 shows the fatty acid composition of *Garcinia kola*, *Tetracarpodium conopodium* and *Tectona grandis*. The oil present in *Garcinia kola* and *Tetracarpodium conopodium* have a very low saturated fraction. 5.72% in *Tetracarpodium conopodium*, and 15.78% in *Garcinia kola* compared to other oils produced in Africa and described by other workers [3,4]. Teak seed oil contained a high percentage (i.e. 59.93%) of saturated fatty acid. The fatty acid profile of saturated fatty acid in *Garcinia kola* were C16:0 (8.32%); C18:0 (7.46%) monounsaturated fatty acid C18:1n9c (32.11%), polyunsaturated fatty acid C18:2n6c (18.05%) C18:3n6 (25.23%) C18:3n3 (1.39%) C20:4n6 (3.98%) C22:2 (2.27%). The fatty acid profile of saturated fatty acid in *Tetracarpodium conopodium* were C16:0 (2.12%); C18:0 (3.52%) and C22:0 (0.08%), monounsaturated fatty acid C16:1 (0.03%), C18:1n9c C20:1 (67.39%), the polyunsaturated fatty acids are C18:2n6c (15.81%), C18:3n6 (0.50%), C18:3n3 (0.56%) and C20:3n6 (0.09%). The fatty acid profile of saturated fatty acid in *Tectona grandis* were C6:0 (2.58%), C10:0 (0.53%), C12:0 (0.61%), C13:0 (0.54%), C14:0 (0.9%), C15:0 (1.04%), C16:0 (26.48%), C18:0 (13.05%) and C22:0 (11.42%), C21:0 (2.16%), C23:0 (0.28%), C24:0 (0.34%). Monounsaturated fatty acid were C16:1 (2.59%), C18:1n9c (17.99%), C20:1 (2.41%), and C22:1n9 (1.09%). Polyunsaturated fatty acid were C18:2n6c (10.31%), C18:3n6 (4.11%), C18:3n3 (0.86%) and C20:5n3 (0.71%).

Tectona grandis contained 59.93% saturated fraction, but it can still be utilized for industrial purposes because of about 40.07% unsaturated fraction it contained. The result in Table 1 indicates that *Garcinia kola* contained high percent of oleic acid (32.11%) which is comparable, however close to the result obtained for peanut (36-72%) [7]. The monounsaturated fatty acid with the highest concentration in Walnut is palmitic acid. It contained 67.39%

Table 1. Fatty acid composition of seed *Garcinia kola*, *Tetracarpodium conopodium* and *Tectona grandis*

Fatty acid	<i>Garcinia kola</i> (%)	<i>Tetracarpodium conopodium</i> (%)	<i>Tectona grandis</i> (%)
C6:0	-	-	2.58
C10:0	-	-	0.53
C12:0	-	-	0.61
C13:0	-	-	0.58
C14:0	-	-	0.90
C15:0	-	-	1.04
C16:0	8.32	2.12	26.48
C16:1	1.18	0.03	2.59
C18:0	7.46	3.52	13.05
C18:1n9c	32.11	9.89	17.99
C18:2n6c	18.05	15.81	10.31
C18:3n6	25.23	0.50	4.11
C20:1	-	67.39	2.41
C18:3n6	1.39	0.56	0.86
C20:4n6	3.98	-	-
C22:0	-	0.08	11.42
C22:1n9cs	-	-	1.09
C20:5n3	-	-	0.71
C24:0	-	-	0.34

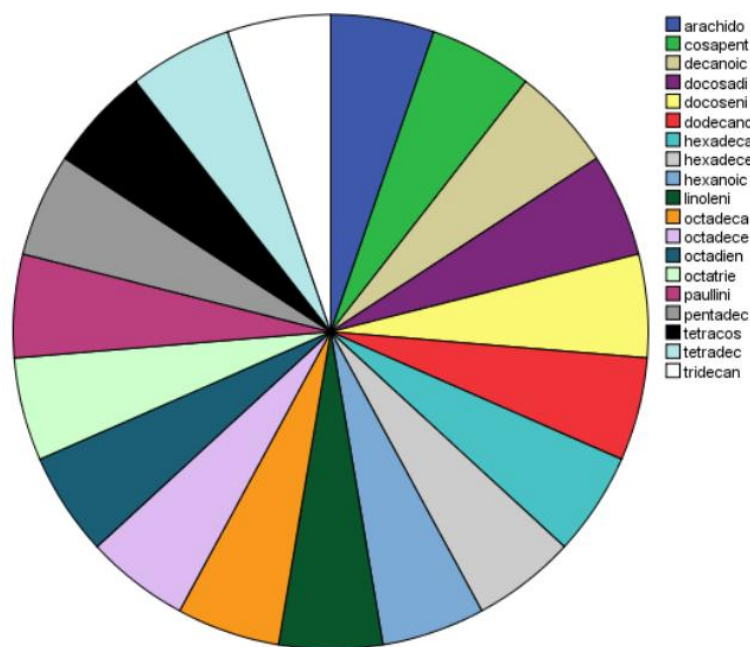


Fig. 1. Pi-charts showing the percentage composition of fatty acid in oil from *Tectona grandis*

which is higher than the value reported for peanut oil [8,9,7]. The fatty acid with the highest percentage in *Tectona grandis* is palmitic acid (26.48%) which is close to 17 – 29% for cotton seed [10,11,12,7].

Garcinia kola contained 8.32%, palmitic acid, while walnut contained 2.12% which is between

2–10% for saffron. *Garcinia kola* contained 25.23% of octadecatrienoic acid while, *Tetracarpodium conopodium* contained 0.50% and *tectona grandis* contained 4.11% of 5,9,12-octadecatrienoic acid.

Garcinia kola contained high percent of omega – 3 fatty acid. *Garcinia kola* contained 25.23%

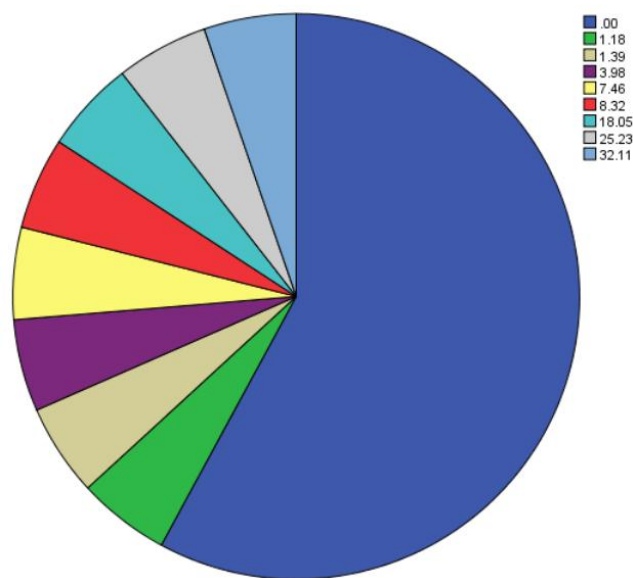


Fig. 2. Pi-chart showing the percentage composition of fatty acids in oil of *Garcina kola*

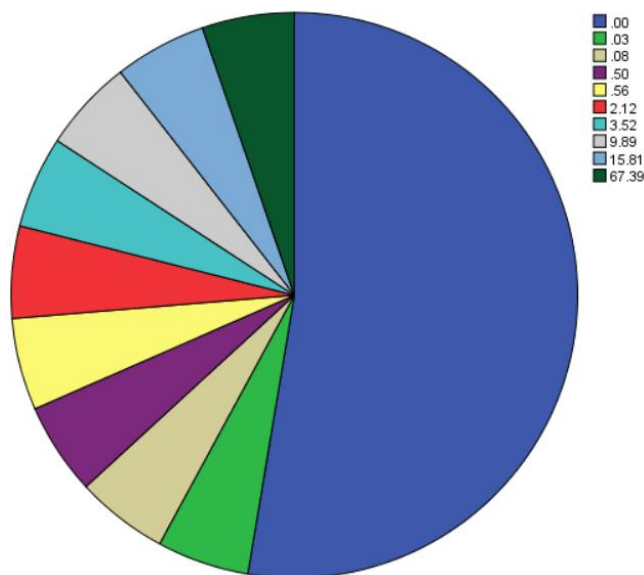


Fig. 3. Pi-chart showing percentage fatty acid composition in *Tetracarpodium conopodium*

Alpha-linoleic acid also found in some vegetable oil. *Tetracarpodium conopodium* contained 0.56% α linolenic acid (C18.3 μ - 3).

Garcina kola contained (18.05%) linoleic acid, *tetracarpodium conopodium* contained 15.81% while *tectona grandis* contained 10.31% of C18:2 μ 6 which are also found in vegetable oils, seeds and nuts.

Eicosapentanoic acid 0.71% is found in *Tectona grandis* but it was absent in both *Garcina kola*

and *tetracarpodium. conopodium* C20:5 μ - 3 omega - 3 fatty acid. It is also found in fish oil.

Garcina kola contained 1.18% hexadecenoic acid while *tetracarpodium conopodium* contained 0.03% and *Tectona grandis* contained 2.59%.

Arachidonic acid (20:4 μ - 6) is present in *Garcina kola*, it contained 3.98%, but it was absent in walnut and teak seed. Moreover α linoleic acid is present in *Garcina kola* (1.39%), *Tetracarpodium conopodium* (0.56%), and *Tectona grandis* (0.86%).

Garcinia kola contained 7.46% stearic acid (C18:0), *Tetracarpodium conopodium* contained 3.52% and *Tectona grandis* contained 13.05%. the fractions that has low percentage in *Tectona grandis* seed oil include the C6:0 (2.58%), C10:0 (0.53%), C12:0 (0.61%), C13:0 (0.54%), C14:0 (0.90%), C15: 0 (1.04%), C20:1 (2.41%), C18: 3n3 (0.86%), C21:0 (2.16%) C22: 1n9 (1.09%), C23:0 (0.28%), C20:5n3 (0.71%) and C24:0 (0.34%).

Oleic acids are the fatty acid encountered at the highest level and are most likely the major fatty acid in the liquid fraction *Garcinia kola* seed oil. The major fatty acid in *Tetracarpodium conopodium* is paullinic acid while the major fatty acid in *Tectona grandis* is palmitic acid.

The oil of *Garcinia kola*, *Tetracarpodium conopodium* and contained a high percentage of unsaturated fatty acid which are essential fatty acid. This will be of great benefit to the human body if used in food formulation. Although *Tectona grandis* contained essential fatty acid, but is has high percentage of saturated fatty acid, so it can be utilized as animal feeds and other fine chemical industries.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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