



IJCRR  
Section: Healthcare  
Sci. Journal Impact  
Factor: 6.1 (2018)  
ICV: 90.90 (2018)

# Comparative Investigation of Physico-Chemical Properties of Two Varieties of Palm Kernel Oil in Use in Ethno Medicine

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## ABSTRACT

**Aim:** There are two common varieties of palm kernel oil in Nigeria namely; *Elaeis guineensis* (*virescens* 'Ojukwu' and *nigrescens*) (family: *Arecaceae*). However, the former has been more popular in traditional medicine. This study aimed to extract the palm kernel oil from the two varieties using n-hexane as organic solvent; subject the extracts to various physico-chemical analysis and by using the data so generated, attempt to rationalize or otherwise justify the extremes in disparity between their potency and efficacy.

**Methodology:** Equal weights of the two varieties of palm kernel: *E. guineensis* (*virescens* 'Ojukwu' - with brilliant colour and *nigrescens*) were granulated separately. The oil was extracted by cold maceration in n-hexane and the oil - extract thereafter recovered by the use of a rotary evaporator. The samples were subjected to GC-MS, refractometry, polarimetry, saponification and iodine values as well as relative densities.

**Results:** The percentage yields were 38.21 for *Virescens* and 41.79 for *Nigrescens*. GC-MS shows that e.g. *Virescens* kernel oil exhibited 18 components against E.g. *Nigerensis* with 16. Some of the components are same for both in the peak area. Relative densities were 0.875 and 0.872 for which saponification and iodine values were 70.64mg/KOH/g oil and 160.53 for *Virescens* as against 62.00/KOH/g oil and 117.06 for *nigrescens*. The refractive index and angle of rotation for *Virescens* were 1.4550 and 159.50° whereas those for *Nigrescens* were 1.4550 and 160.50°.

**Conclusion:** Though some of the differences from the data between the two varieties were not statistically significant at  $p \leq 0.05$ , nevertheless, the wider peak areas depicting; higher concentrations for *virescens* and also the degree of unsaturation associated with higher iodine values could all be linked to the extreme versatility of the *virescens*. The unsaturated fatty acids are easily metabolized in human body to physiologically important prostaglandins.

**Key Words:** *Elaeis guineensis-virescens* 'Ojukwu' and *nigrescens*, PKO, Physicochemical parameters, Greater degree of unsaturation for *virescens*

## INTRODUCTION

*Elaeis guineensis* – Jacq (family: *Arecaceae*) – Palm tree, has two varieties that are prominently used in traditional medicine. Those varieties are the *Virescens* and *nigrescens*. The two, shown in figure 1, are distributed in equatorial tropical rain forest regions of West Africa<sup>1,2</sup>. Traditional remedies were derived from palm to heal many diseases throughout these regions.

The fixed oil-bearing plants include; palm, coconut, olive, castor, linseed and more. The three distinct groups of oil crops are<sup>3</sup>;

- Those that are annual or biannual such as soybeans, sunflowers, groundnuts
- The perennial tree crops such as coconuts
- Crops such as cotton and corn germ.

It was found that Traditional African religion has a tremendous influence on the practice of Traditional medicine<sup>4</sup>. It is further generally acknowledged that negative spiritual influences had an impact on human health<sup>5</sup>. Those negative spiritual effects are often associated with witchcraft, sorcery, broken taboos, displeased ancestors, spirits or deities<sup>6</sup>. Consequently, remedies were found in the application of tangible

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ISSN: 2231-2196 (Print)

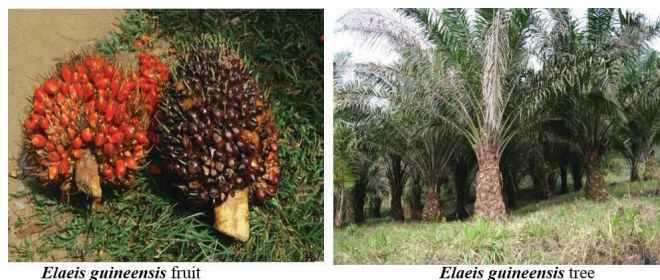
ISSN: 0975-5241 (Online)

Received: 10.04.2020

Revised: 20.05.2020

Accepted: 05.06.2020

objects such as palm fruit and kernel oil or recourse to intangible behaviors as in incantation<sup>7,8</sup>.



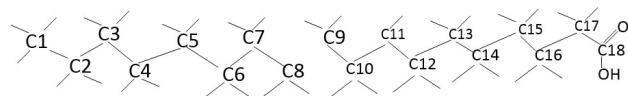
**Figure 1:** Photographs of palm tree (*Elaeis guineensis*) and fruits.

Apart from the medicinal applications, palm has immense economic values in tropical West Africa; industrial, food and nutrition, fuel, fuel additives, plastic, surfactants and good energy source.

The ethnomedicinal uses, especially for the *Virescens* include; antidote for certain types of toxic and allergic conditions, several skin ailment, control of convulsion in children, stabilization of certain adverse influences. Most of these ethno uses may not be eventually proven empirically with an experimental model despite the level of advances in analytical tools. The elusive experimental nature may also be attributable to the concept of three-dimensional mind and limitations of time and space<sup>9</sup>.

Currently, Palm Kernel oil (PKO) is used as a liniment for indolent tumours<sup>10</sup>. It exhibits some level of anti-microbial activity<sup>11</sup>. Other medicinal uses include treatment of gastrointestinal disorders, antioxidant properties, anticancer, cardiovascular and hepatoprotective properties<sup>12</sup>.

Triglycerides make up to 95 % of edible fatty acids. Fats and oils belong to the group of lipids; and are found in both plants and animals. Fatty acids are the major components of fats and oils. They are very important sources of energy for the humans, component of the membrane surrounding the sub-cellular organelles and carrier tool for lipid-soluble vitamins.<sup>13</sup>



Methyl hydrophobic and the carboxylic end are prominent

**Figure 2:** The structural features of a typical fatty acid.

Essential fatty acids (Linoleic and alpha-linolenic acids) are largely polyunsaturated. Most of the naturally important fatty acids occur in *cis*-transfiguration but with the presence of double bonds. The *trans*-configuration is equally possible.<sup>14</sup>

The unsaturated fatty acids due to the presence of double bonds show remarkable difference from the saturated coun-

terparts in shapes, biological, physicochemical properties such as Melting Point(M.P.), Relative Density(R.D.), refractive index, optical rotation, the iodine values saponification (-SH) group or photolysis<sup>15</sup>.

Generally, unsaturated fatty acids are more unstable, exhibit higher degree of liquidity and therefore are chemically more susceptible to undergo chemical addition reactions than the saturated molecules which are relatively inert. Further, these polyunsaturated fatty acids have been identified as precursors of prostaglandins hence the essential fatty acids are enzymatically easily metabolized (lipoxidation) in humans to produce physiologically important prostaglandins.<sup>16</sup>

For fatty acids that occur in humans, double bonds are rarely inserted in carbon atoms less than 16 due to lack of desaturases enzymes capable of influencing double bonds between carbons 1-7<sup>17</sup>. This is unlike plants, where double bonds can be found in carbon 3 and 6 from the methyl terminal group. By this, there could be a possibility of 1-6 double bonds in a single fatty chain.<sup>18</sup>

The aims and objectives of this study, therefore, were to extract the palm kernel oil from the two varieties using *n*-hexane as organic solvent, subjected the extracts to various physico-chemical analysis and by using the data so generated, attempted to rationalize or otherwise justify the extremes in disparity between the potency and efficacy of their biological activities.

## MATERIALS AND METHODS

The ripped fresh fruit bunches of the two palm varieties; *Elaeis guineensis* (*virescens* and *nigrescens*) were collected from plantations in Obiakpo Local Government Area of Rivers State, Nigeria, The authentication was at the Herbarium of Department of Plant Science and Biotechnology, University of Port Harcourt. The samples were processed by following a modification of methods earlier reported<sup>19</sup>. They were then subjected to manual threshing to release the palm fruit lets from the bunches; sterilized (heat was applied to partially cook the fruits and may serve in terminating certain undesired enzymatic actions.); digested to assist in separation of the nuts from the pulp and the nuts were eventually cracked to obtain the palm kernel seeds. Thereafter, equal weights of the two varieties of samples (390 g each) were milled using Delmar machine to get the desired particle sizes.

The extraction of the palm kernel oil was achieved by the adoption of solvent extraction method as reported<sup>16</sup>. The milled palm kernel samples were macerated with

*n*-hexane (500 ml each) for 24 h at room temperature with agitation at regular intervals. The samples were filtered to obtain the palm-kernel oil extract and *n*-hexane mixture. The respective pure palm kernel oil (PKO) samples were

recovered *en vacuo* in a rotary evaporator. The two PKO samples (A for *virescens* and B for *nigrescens*) were further subjected to; saponification and iodine value tests, refractive index, polarimetry, relative density and GC-MS.

## RESULTS

Result of the percentage yield of *Elaeis guineensis* varieties (*virescens* 'Ojukwu'-A and *nigrescens* -B):

A = 38.21 % (mean weight of nut= 1.336 g)

B = 41.79 % (mean weight of nut= 1.113 g)

**Table 1: Result of Saponification and Iodine values for *Elaeis guineensis* varieties (*virescens* 'Ojukwu'-A and *nigrescens* -B):**

PKO Samples	Saponification Value (mg / KOH / g oil)	Iodine Value
A	70.65	160.50
B	62.00	117.10

**Table 2: Result of Refractive Index, the Optical Rotation and Relative Density of *Elaeis guineensis* varieties (*virescens* 'Ojukwu'-A and *nigrescens* -B):**

PkOv Samples	Refractive Index	Optical Rotation (°)	Relative Density
A	1.4550	159.50	0.875
B	1.4520	160.50	0.872

GC-MS result showed that *virescens* kernel oil exhibited 18 components against *nigerensis* with 16. Some of the components presented as same for both samples A and B in the Retention Time; Area: Height ratio and in peak areas. The rest of the peaks where areas were larger for sample A than B reflected higher concentrations of components present in same sample.

Some of the fatty acids and esters components identified in the mass spectroscopic fragments included; Octanoic acid, 2-Undecanone, Dodecanoic acid, Tetradecanoic acid, Chloromethyl octyl ether, Acetic acid, chloro-, decyl ester, n-Hexadecanoic acid, 9-Octadecenoic acid, and 9-Decenoic acid.

## DISCUSSION

Though the brilliant colour of sample A is more prominent than sample B, however the mean weights of their nuts and percentage yields did not show any significant differences at 1.336 g;38.21 % for A and 1.113 g;41.79 % for B respec-

tively.

As shown in Table 1, the Iodine values of 160.50(A) and 117.10(B) indicates a remarkable difference. This means degree of unsaturation was higher in sample A than B. The respective values of Refractive Indices, Optical Rotation and Relative Densities as shown in Table 2 did not on the other hand exhibit any statistically significant difference at  $p \leq 0.05$ , however, the wider peak areas depicting higher concentrations for *virescens*(A)and also the degree of unsaturation associated with higher iodine values could all be linked to the extreme versatility of the *virescens*. Further still, like other Essential fatty acids with unsaturation, this *virescens*(A) could be metabolizable to prostaglandins in the human body with vital cell functions.

## CONCLUSION

There is a need to characterize and elucidate the exact structures of the polyunsaturated fatty acids of *virescens* PKO. Additionally, there must be a meaningful effort for the conservation of this valuable plant to avoid extinction. A good pharmaceutical formulation of this product would, therefore, offer yet another potent health remedy to the world.

## ACKNOWLEDGEMENT

Staff members and Laboratory facilities of Pharmacognosy & Phytotherapy and Pharmaceutical & Medicinal Chemistry Departments both of Faculty of Pharmaceutical Sciences, University of Port Harcourt. Rivers State, Nigeria.

I also wish to thank all the Authors, Editors and Publishers of the numerous articles consulted in the course of this research paper.

## Conflict of Interest

There was no conflict of interest involved in this research work.

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