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CHEMICAL ANALYSIS OF *Cucumeropsis mannii* (Naud.) AND *Citrulus lanatus* (var. *citroides*) SEED OILS IN RELATION TO THEIR POTENTIAL AS DOMESTIC AND INDUSTRIAL OILS.

***A. N. Kolawole., * D. O. Ayeoba**

* Department of Biochemistry, The Federal University of Technology, Akure. Ondo State. Nigeria.

Corresponding Author's e-mail: ankolawole@futa.edu.ng

ABSTRACT

The proximate analysis for *Cucumeropsis mannii* (Naud.) and *Citrullus lanatus* (var. *citroides*) seeds was carried out to determine their potential as efficient oil sources. *Cucumeropsis mannii* (Naud.) and *Citrullus lanatus* (var. *citroides*) oils were obtained using n-hexane (25^{o}C). The physicochemical properties of the oil extract including the refractive index, specific gravity, acid value, free fatty acid content, saponification value, unsaponifiable matter content, peroxide value, and the iodine value. The resulting values were compared with international standards for edible oils. Proximate analysis of *Cucumeropsis mannii* (Naud.) and *Citrullus lanatus* (var. *citroides*) seeds showed a total fat content of 48.30% and 52.2% respectively. The polyunsaturated fatty acids content of *Cucumeropsis mannii* (Naud.) and *Citrullus lanatus* (var. *citroides*), demonstrated by the high saponification values (161.29 and 189.34 respectively) and iodine values (77.4 Wij's and 80.64 Wij's respectively) indicate good health potential as cooking oils while the low peroxide (0.60mg/kg and 0.45mg/kg respectively) and acid values (1.26mgKOH/g and 0.98mgKOH/g respectively) of the oils demonstrate the resistance of these oils to rancidity. The proximate analysis of the seeds and physicochemical properties of the extracted oils placed *C.lanatus* (var. *citroides*) in a brighter position of potential as a cooking oil source with a higher total fat content of 52.20% compared to *C. mannii* (Naud.)'s 48.30%.

Keywords: Seed oils, Melon seeds, *C. mannii* (Naud.), *C.lanatus* (var. *citroides*), Physicochemical analysis.

INTRODUCTION

Most of the dietary lipids are in the form of triglycerides which are fatty acids ester of glycerol. They may be solid (referred to as fat) or liquids (referred to as oils), depending on the properties of the fatty acids that make up the triacylglycerols (Anhwange *et al*, 2010). Usually, this is determined by the type of organism which synthesizes the triacyglycerols with plants producing oils and animals producing fats. Due to the extensive demands for oils for human and animal consumption and for industrial applications as well, there is an increasing need to search for

oils from non-conventional but efficient and feasible sources to augment, or possibly, replace the available oil sources. Apart from potential direct use as cooking oils, *Cucurbitaceae* seed oils are also utilisable for the manufacture of other food products such as mayonnaise and soap (Fokou *et al*, 2009) as well as industrially important products such as metallic soaps, for use in paint production (Essien et al, 2012)

There are nearly 95 genera and more than 965 species in the family *Cucurbitaceae Juss*., which is a moderately large family of flowering plants (Christenhusz and Byng, 2016). Though most of the fruits of the Cucurbitaceae bear numerous seeds usually moderately rich in fat, relatively little use of them has been made as commercial sources of oil (Fokou et al, 2009). About three genera of Cucurbitaceae bear the common name, melons. They are *Cucumis*, *Citrullus* and *Cucumeropsis*.(Ajuru and Okoli, 2013). *Cucumeropsis* is represented by one specie in Nigeria, C. *mannii* Naud., while *C. lanatus* (var. *citroides*) under the genera, *Citrullus lanatus*, is a name which applies to both Watermelon and Brown-seeded melon (Ajuru and Okoli, 2013) also known as the Citron melon (Nesom, 2011). Brown seeded melon *Citrullus lanatus* var. *citroides* and water melon *Citrullus lanatus* (Thunb.) var. *lanatus* are distinguished mostly by the appearance of their seeds and the structure of their leaves. In brown-seeded melon, the leaves are more deeply cleft, longer and wider those of watermelon plants (Ajuru and Okoli, 2013), the seeds are brownish yellow, oval with thick margins and about 1.6cm long by 0.9cm wide. The fruit of *C. lanatus* (var. *citroides*) has a hard white flesh, rendering it less likely to be, unlike eaten raw watermelons (Laghetti and Hammer, 2007). The seeds of watermelons vary considerably in colour, from brownish-yellow to brownish-black and black, with seed dimensions of each type being about 0.9cm long by 0.5cm wide, 1.0cm long by 0.6cm wide and 1.2cm long by 0.8cm wide respectively (Ajuru and Okoli, 2013).

Both *Citrullus lanatus* (var. *citroides*) and *Cucumeropsis mannii* (Naud.) seeds are consumed as *Egusi* in Nigeria (Aloho and Johnson, 2012; Achigan-Dako *et al*, 2008). Both plants have also been locally exploited to produce cooking oil, however, to only a very limited extent. While previous work has evaluated the potential of *Citrullus lanatus* (Thunb.) var. *lanatus* (water melon) seeds as an oil source (Igwemmar et al, 2018), not much attention has been paid to the less popular *Citrullus lanatus* (var. *citroides*). This paper aims at exploring the prospect for edible oil production from *Citrullus lanatus* (var. *citroides*), as well as *Cucumeropsis mannii* (Naud.), by comparing the yield and quality of the oil produced from them as pertaining to their health benefits and longevity.

MATERIALS AND METHODS

Sample

The melon seeds (*Cucumeropsis mannii* (Naud.), *Citrullus lanatus* (var. *citroides*)) were bought at the local market Oja Oba, Akure, Ondo State, Nigeria. The seeds were taken to Crop Soil and Pest Management Department in Federal University of Technology, Akure for identification.

Reagents

All reagents used were of analytical grade.

Preparation of melon seed samples for analysis.

The melon seeds were shelled and then sun-dried for two days and ground into powdery form using an Thermoline ® blender.

Proximate analysis of Melon seeds samples.

Moisture, ash, crude protein, crude fibre, total fat and carbohydrate content determination was carried out as described by AOAC (2018) and the carbohydrate content was obtained by difference.

Determination of Moisture Content

Homogenised samples of 5 grams were weighed into petri-dishes and dried in an electric oven at 105°C for 2 hours. The sample was allowed to cool for 30 minutes and reweighed. Alternating processes of heating, cooling and weighing were continued until a constant weight (W_3) was obtained. The moisture content was determined as the difference between the weight of the sample, before and after drying, multiplied by 100.

$$\%\text{Moisture Content} = \frac{(W_1 - W_3)}{(W_2 - W_1)} \times 100 \quad \ldots\ldots (1)$$

(AOAC, 2018)

Ash Content Determination

Clean and dried crucibles (W_1) were weighed using a METTLER® Toledo PM400 Balance. A sample of 1g (W_2) was weighed into a crucible, which was then placed in a muffle furnace and gently heated to combustion, followed by heating at 500°C for 3hours. This was continued until a light gray ash was obtained. The crucibles and the content were then cooled in a desiccator and weighed (W_3). The ash content was then determined as;

$$\%\text{Moisture Content} = \frac{(W_1 - W_3)}{(W_2 - W_1)} \times 100 \quad \ldots\ldots (2)$$

(AOAC, 2018)

Determination of Crude Fibre Content

Samples of 1g each were weighed into a conical flask (W_1), followed by the addition of 200ml of boiling 2.5% H_2SO4. The solution was boiled gently for 30mins. The solution was then filtered through a muslin cloth, stretched over 9cm butcher funnel and mixed with hot distilled water. The residue was scrapped back into the flask with a spatula and 200ml of boiling 1.25% NaOH was added and the solution was allowed to boil gently for 30mins with boiling fingers used to maintain a constant volume. This was again washed thoroughly with hot distilled water and was rinsed once with 10% HCL and twice with industrial methylated spirit. The residue was rinsed finally 3times with petroleum ether (40°- 60°C boiling range) and was allowed to drain, dried and scrapped into crucible. The residue was dried overnight at 105°C in the oven, cooled in a desiccator and then weighed (W_3). It was ashed at 550°C for 90 minutes in a muffle furnace and then cooled in a desiccators and reweighed (W_3).

$$\%\text{Crude Fibre} = \frac{(W_2 - W_1)}{W_1} \times 100 \quad \ldots\ldots\ldots\ldots (3)$$

(AOAC, 2018)

Determination of Crude Protein Content

The Kjeldahl method was used for the determination of percentage crude protein. Digestion: 0.5g of the samples was weighed into Kjeldahl digestion flask and selenium catalyst was added. 10ml concentrated H_2SO_4 was used to hyrolyse the sample at 420^{o}C for 2 h. After cooling, distilled water was added to the hydrolysate before neutralization and titration. The protein content was obtained by multiplying the nitrogen content by 6.25 (Kjeldahl, 1883) in each sample.

Determination of Total Fat Content

The fat content was determined using a Soxhlet apparatus. 2 grams of sample was weighed into a pre-weighed thimble previously dried in an oven and placed in a Soxhlet extractor. Petroleum ether of boiling point range 60-80°C was used as the solvent for extraction for 6 hours, after which the condenser was detached. The thimble with defatted sample was removed, and dried to a constant weight in an oven at 5°C. The difference between the weight of the thimble before and after drying was recorded in other to obtain the fat extracted which was then calculated (Danlami *et al*, 2014).

$$\%\text{Fat Content} = \frac{\text{Weight of Fat Extracted}}{\text{Initial Weight of Sample}} \times 100 \quad \ldots\ldots (4)$$

(AOAC, 2018).

Carbohydrate Content Determination

The carbohydrate content of the sample was determined using difference method (Ali *et al*, 2008)

% Carbohydrate = 100 - (% ash + % protein + % fat + % fibre + % moisture) ..... *(5)*

(AOAC, 2018).

Extraction of Oils from the Melon Seeds.

The extraction procedure was carried by Soxhlet *n*-hexane extraction as described by Krzyczkowska and Kozlowska (2017) with some modifications.

The seed samples were weighed, 150g of the divided sample was dissolved in 600ml of n-hexane in a glass jar. It was then covered with aluminium foil and left to stand for 72 hours. Filtration using a muslin cloth followed. The supernatant was transferred to the rotary evaporator to remove all solvents and the resulting oil was recovered in a collecting flask.

Thin layer chromatography (TLC) of the extracted oil samples

Thin layer chromatography oof the oil was performed using 0.20mm thick stationary phase of 10g/ml silica gel. The origin spot contained 25% extracted oil sample, 25% ethanol and 50% chloroform. A solvent mixture of n-hexane, ethylether and acetic acid in the ratio of 7:3:0.1 was prepared according to Mangold (1969) and used to elute the sample.

Retention factor (Rf) values were calculated using the following formula:

$$\text{Rf Value} = \frac{\text{Distance moved by the band}}{\text{Distance moved by the solvent front}} \quad \ldots\ldots (6)$$

(Mangold, 1969).

Determination of the physicochemical properties of the Melon seed oil extract

The physico-chemical properties (saponification value, unsaponifiable matter content, acid value, peroxide value, iodine value, specific gravity and free fatty acid content) of the oil were carried out using the method described by Pearson (1981). Refractive index was determined as described by Kyari (2007).

Determination of Acid Value

2g of the oil sample was weighed into 100ml conical flask and 25ml of 25% absolute ethanol was added to it. 25ml of petroleum ether and 1ml phenolphthalein indicator was added. The solution was warmed to 40°C. It was then titrated with 0.1M potassium hydroxide (KOH). Acid value determination experiments were performed in triplicates; the mean and standard deviation values were calculated and recorded.

The acid value was obtained from the titre value using the formula;

$$\text{Acid Value} = \frac{\text{Titre Value} \times 56.1 \times \text{Molarity KOH}}{\text{Weight of sample}} \quad \ldots\ldots (7)$$

(Ronald and Ronald, 1991)

Determination of Iodine Value

An oil sample of 0.3g was weighed into 250ml conical flask. 10ml of chloroform and 20ml of Wij's solution were added into the flasks, covered and left in the dark for 30minutes. 20ml of 20% potassium iodide (KI) solution was pipetted and made up to 100ml using distilled water. The solution in the conical flask was then titrated against 0.1M sodium thiosulphate using starch indicator. The blue-black colouration disappeared to colourless and the titre value was recorded. Iodine value determination experiments were performed in triplicates; the mean and standard deviation values were calculated and recorded.

The blank titration was equally carried out.

$$\text{Iodine value} = \frac{(b-a)\ \text{ml} \times 12.69 \times \text{M}}{\text{Weight of sample}} \quad \ldots\ldots (8)$$

(Michael *et al*, 2014)

a = Titre value of the sample

b = Titre value of the blank

M = Molarity of Na_2S_2O, 0.1M

12.69 = Molecular weight of iodine

Determination of Peroxide value

An oil sample of 1g of the was weighed into a 250ml conical flask and solvent mixtue of 30ml acetic acid and 20ml $CCl_4$was added to the oil sample. 10ml of 5% saturated potassium Iodide solution was added and warmed on a water bath for 60 seconds after which it was titrated with 0.02m sodium thiosulphate. Peroxide value determination experiments were performed in triplicates; the mean and standard deviation values were calculated and recorded.

Blank titration of the oil sample was also carried out.

$$\text{Peroxide value} = \frac{(b-a)\text{ ml} \times 100 \times M}{\text{Weight of sample}} \quad \text{.....} \quad (9)$$

(Michael *et al*, 2014)

Where a = Titre value of sample

b = Titre value of blank

M = Molarity of sodium thiosulphate (0.02M)

Determination of Free Fatty Acid Content

Oil sample of 1g was dissolved in 20ml of petroleum ether inside 250ml conical flask. It was titrated with 0.1 M sodium hydroxide (NaOH) using phenolphthalein as indicator. Free fatty acid content determination experiments were performed in triplicates; the mean and standard deviation values were calculated and recorded.

The free fatty acid content was calculated from the titre value from the formula;

$$\text{Free fatty acid content} = \frac{0.282 \times \text{Titre value}}{\text{Weight of sample}} \quad (10)$$

(AOAC, 2018)

Determination of saponification value

Oil sample weighing 1g of oil sample was added into 250ml conical flask. 30ml of alcoholic potassium hydroxide was added and heated for 3 minutes with occasional shaking. 1ml of phenolphthalein was then added as indicator The sample solution was titrated while still hot with 0.5M HCl. A blank containing all other components of the final solution except the oil extract blank was also prepared (AOAC, 2018). Saponification value determination experiments were performed in triplicates; the mean and standard deviation values were calculated and recorded.

$$\text{Saponification Value} = \frac{(b-a)\text{ ml} \times 56.1 \times M}{\text{Weight of sample}} \quad (11)$$

(AOAC, 2018)

Where a = Titre value of sample

b = Titre value of blank

Determination of unsaponifiable matter content.

The neutralised liquid from the saponification value test was the subject of this experiment. The neutralized liquid was transferred quantitatively to a separating funnel using 50mL of distilled water and extracted 3 times with warm 50 mL diethyl ether. All extracts were combined and washed vigorously with 20mL portions of distilled water and evaporated to dryness, dissolved in 2mL diethyl ether and 10 mL of neutralized ethanol. This solution was titrated with 0.1M alcoholic potassium hydroxide. Unsaponifiable matter content value determination experiments were performed in triplicates; the mean and standard deviation values were calculated and recorded.

The unsaponifiable matter was calculated as;

$$\text{Unsaponifiable matter} = \frac{M2 - 0.028 \times 1000}{M1} \quad (12)$$

(AOAC, 2018)

Determination of specific gravity

This is the oil sample in gram weight to that of equal volume. The oil sample was melted. A dried specific gravity bottle was weighed (W_1). The specific gravity bottle was filled

with 10ml of distilled water and was weighed (W_2). The specific gravity bottle was emptied and dried. 10ml of the oil sample was weighed into the specific gravity bottle and was weighed together (W_3). Specific gravity determination experiments were performed in triplicates; the mean and standard deviation values were calculated and recorded.

$$\text{Specific gravity} = \frac{W3 - W2}{W2 - W1} \quad \text{.....} \quad (13)$$

(AOAC, 2018)

Determination of refractive index.

A METTLER ® refractometer was used in this determination using standard methods as described by Kyari (2007). Refractive index determination experiments were performed in triplicates; the mean and standard deviation values were calculated and recorded.

RESULTS AND DISCUSSION

Proximate analysis of the *C. mannii* (Naud.) and *C. lanatus* (var. *citroides*) revealed higher moisture (8.11% and 4.49% respectively), ash (5.17% and 4.00% respectively), protein (28.70% and 27.43% respectively) and carbohydrate (8.32% and 3.02% respectively) content for *C. mannii* (Naud.) compared to *C. lanatus* (var. *citroides*) seeds. C*itrullus lanatus* (var. *citroides*) however had the higher total fat content (52.2% for *C. lanatus* (var. *citroides*) to 48.30% for *C. mannii* (Naud.)) and higher fiber content (5.175% for *C. lanatus* (var. *citroides*) to 5.02% for *C. mannii* (Naud.)) relative to *C. mannii* (Naud.) (Table 1).

Thin-layer chromatography supports the identity of a compound in a mixture by comparing the retention factor (Rf) of the sample to the Rf of a standard mxture. The lipid classes are divided into neutral lipids including triglycerides fatty acids and cholesterol and polar lipids such as phospholipids and sphingolipids.

Physicochemical analysis of the extracted oils showed promising indications towards the health and longevity of the oil samples (Table 3). The iodine value of *C. lanatus* (var. *citroides*) and *C. mannii* (Naud.) oils was 80.640 Wij's and 77.540 Wij's respectively. The peroxide value is the measure of oxidative rancidity of oil (Ekpa and Ekpa, 1996). The peroxide value of *C. lanatus* (var. *citroides*) and *C. mannii* (Naud.) was determined to be 0.45 mg/kg and 0.6 mg/kg respectively.

The acid values of the oils were found to be 0.98 mgKOH/g for *C. lanatus* (var. *citroides*) and 1.26 mgKOH/g for *C. mannii* (Naud.). Acid value of oils represent the extent to which the glycerides have been decomposed by lipase action (Anhwange *et al*, 2010).

The Free fatty acid values were found to be 0.05% and 0.065% for *C. lanatus* (var. *citroides*) and *C. mannii* (Naud.) respectively.

The saponification value of *C. lanatus* (var. *citroides*) oil was 189.34 while that of *C. mannii* (Naud.) oil was found to be 161.29. A high saponification value implies greater proportion of fatty acids of low molecular weight (Anhwange *et al*, 2010).

The specific gravity of the oils was found to be 0.986 for both oils. Specific gravity and refractive index measures the purity of oil.

Table 1: Proximate analysis of *Cucumeropsis mannii* (Naud.) and *Citrullus lanatus* (var. *citroides*) seeds.

Constituents	*Cucumeropsis manni* (Naud.)	*Citrullus lanatus*(var. *citroides*)
Moisture %	8.11 ± 0.003	4.49 ± 0.030
Ash%	5.17 ± 0.120	4.00 ± 0.100
Protein %	28.70± 3.010	27.43±3.110
Fibre %	5.02 ± 0.010	5.17 ± 0.010
Fat %	48.30 ± 0.004	52.20± 0.004
Carbohydrate %	8.32 ± 0.005	3.02± 0.030

The data represents mean ± standard deviation of triplicate readings.

Table 2: Thin layer chromatography carried out using Hexane: Ethylether: Acetic Acid (7:3:0.1) as the solvent system.

Sample	Retention Factor	Lipid Class
C. *mannii* (Naud.)	0.20	Sphingolipids
	0.31	Phospholipids
	0.37	Fatty acids and Cholesterol
	0.49	Fatty acids and Cholesterol
	0.72	Triacylglycerols
C. lanatus (var. *citroides*)	0.21	Sphingolipids
	0.31	Phospholipids
	0.36	Fatty acids and Cholesterol
	0.49	Fatty acids and Cholesterol
	0.76	Triacylglycerols

Table 3: Physico-chemical analysis of oils extracted from *Cucumeropsis mannii* (Naud.) and *Citrullus lanatus* (var. *citroides*).

Physicochemical	*Cucumeropsis mannii* (Naud.)	*Citrullus lanatus* (var. *citroides*)
Refractive index (at 40°C)	1.466 ± 0.001	1.444 ± 0.001
Specific gravity (at 25°C)	0.986± 0.100	0.986 ± 0.10
Acid value (mgKOH/g)	1.260 ± 0.140	0.980 ± 0.140
Free fatty acid (%)	0.065 ± 0.010	0.050 ± 0.010
Saponification value	161.290 ± 7.210	189.340 ± 7.010
Unsaponifiable matter (%)	0.320 ± 0.050	0.255 ± 0.005
Peroxide value (mg/kg)	0.600± 0.100	0.450 ± 0.050
Iodine value (Wij's)	77.540± 0.100	80.640 ± 0.100

The data represents mean ± standard deviation of triplicate readings.

DISCUSSION

The observed superiority of the total fat content of *C. lanatus* (var. *citroides*) relative to *C. mannii* (Naud.) agrees with the findings of Loukou *et al.* (2007) which recorded fat content at 56.67% and 45.89% for *C. lanatus* (var. *citroides*) and *C. mannii* (Naud.) respectively. The total fat content of both seeds appreciably exceeded that of some conventional cooking oil sources such as soya (28.20%) (Etiosa *et al*, 2017) and groundnut (47.00%) (Atasie *et al*, 2009)), indicating that the melon seeds may be more promising oil sources for future exploitation.

Neutral lipids eluted faster in the relatively nonpolar solvent system in the chromatogram, whereas polar lipids like phospholipids and sphingolipids migrated much more slowly (Hoover, 1995). Thus the top migration regions on the chromatography plate are made up of neutral the oils' neutral lipids while the lower migration band is made up of the polar constituents. The lowest band of separation corresponds with sphingolipids, the second and third lowest with phospholipids, the fourth with fatty acids and cholesterol while the topmost band corresponds with triacylglycerols (Hoover, 1995).

The iodine value is a measure of the degree of unsaturation in oil. The higher the iodine value, the more the C=C bonds are present in the fat (Naghshineh *et al*, 2010). The iodine value of *C. lanatus* (var. *citroides*) closer to those of unsaturated fatty acid rich oils such as peanut (79.0 -81.0 Wij's), cottonseed (91.0-100.0 Wij's), sesame oil (104.0-120.0 Wij's), sunflower (110.0-118.0 Wij's) but lower than that of soybean oil (124.0-139.0 Wij's) (Aremu *et al*., 2006). The dietary requirement for lipids is obtained from the polyunsaturated fatty acids, linoleic and linolenic fatty acids. Both fatty acids are 18 carbon atoms polyunsaturated differing in the number of double bonds (Anhwange *et al*, 2010). Byrd-Bredbenner *et al*. (2007) reported that linoleic acid (LA) serves as a precursor to arachidonic acid *in vivo*, both fatty acids being required for prostaglandin synthesis, which regulate heart rate, blood pressure, blood clotting, fertility, conception, and play a role in immune function by regulating inflammation (Nakamura, 2000). These essential fatty acids

are also needed for proper growth in children, particularly for neural tube development and maturation of sensory systems (Gropper *et al*., 2009).

Oxidative rancidity is the addition of oxygen across the double bonds in unsaturated fatty acids in the presence of enzyme or certain chemical compounds. The odour and flavour associated with rancidity are due to liberation of short chain carboxylic acids. High peroxide values are associated with higher rate of rancidity. Variation of peroxide value could be due to the number of unsaturated fatty acid content, since rate of autoxidation of fats and oils increases with increasing level of unsaturation. The low peroxide values of the oils indicate that they are less liable to oxidative rancidity at room temperature (Anyasor *et al*, 2009).

Acid value of oils represent the extent to which the glycerides have been decomposed by lipase action (Anhwange *et al*, 2010). The decomposition is usually accelerated by heat and light. Deterioration of grains and milled products had been reported to be implicated by increasing acidity. The acids that are usually formed include free fatty acids, acid phosphates and amino acids. Free fatty acids are formed at a faster rate than the other types of acids (Baumer, 1996). The lower acid values also indicate that the oils could be stored for extended periods without deterioration.

The free fatty acid content values of both oils were below the 5.00% which is the maximum fatty acid content for non-rancid oil (Savage *et al*, 1997).

The Saponification value results indicate that the oils contained higher proportions of low molecular weight fatty acids. The values compared favourably with the saponification values of Palm oil (196 -205), Olive oil (185-196), Soya bean oil (193) and Linseed oil (193 -195) (Folkard and Sutherland, 1996) and is thus suitable for industrial soap production (Aliyu *et al*, 2010). Unsaponifiable matter content of 0.255% and 0.320% were recorded for *C. lanatus* (var. *citroides*) and *C. mannii* (Naud.) oil respectively. Lower percentage of unsaponifiable matters as obtained in the sample of points to lower amounts of hydrocarbons, higher alcohols and sterols (Ali *et al*, 2007), thus indicative of good health benefits in addition to its high unsaturated fatty acid content.

Specific gravity and refractive index measures the purity of oil. The results indicate that the oils extracted from both sources are of high purity (Anhwange\ *et al*, 2010).

CONCLUSION

The results of this study revealed that the oils of *Cucumeropsis mannii* (Naud.) and *Citrulus lanatus* (var. *citroides*) are of high quality, appreciable shelf life, and nutritional value. *C. lanatus* (var. *citroides*) showed higher promise in terms of total oil yield as compared to *C. mannii* (Naud.). Our results prove that both *C. manni* (Naud.) and *C. lanatus* (var. *citroides*) compare favourably to many of the seeds in mainstream use in oil production in terms of the quantity of oil obtainable, as well as meeting international quality standards for edible oils. This suggests, strongly, that *C. mannii* (Naud.) and *C. lanatus* (var. *citroides*) need to be taken off the relegated position as substinence crops to allow for the large scale production of their seed oils for domestic and industrial use, taking advantage of their expansive geographical growth range in West Africa.

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