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Evaluation of Physicochemical Properties, Phytochemicals and Mineral Composition of *Cocosnucifera*l. (Coconut) Kernel Oil

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Abstract: *Due to the abundance of Cocosnucifera L. (coconut) in southern part of Nigeria and considering its high consumption, this work was carried out to determine the potential applications of the seed kernel by investigating the physicochemical characteristics as well as the phytochemical and mineral compositions of its extracted oil content. The oil was extracted using Soxhlet apparatus, and the physicochemical characterization, together with the phytochemical screening and determination of the mineral composition were carried out using standard methods. The physicochemical parameters of the extracted oil were as follows: acid value 0.7963± 0.21 mg KOH/g, saponification value 7.74 ± 0.73mg KOH/g, iodine value 46.8 ±0.63 I_2/100g, free fatty acid 20.49±1.46 (% oleic acid), peroxide value (mEqH_2O_2/100g) 10.0 ± 5.0, specific gravity (g) 0.95±.0.05.The oil was observed to have clear white appearance, liquid at room temperature and has a nutty smell when fresh and unpleasant when rancid. Cocosnucifera L. seed kernel has low oil content of 26.61%. The phytochemical analysis of the seed oil revealed the presence of saponins, alkaloids, flavonoids, steroids, and terpenoids, and absence of cardiac glycosides, tannins, phenols, phlobatanins and anthraquinones. The result of the mineral element analysis revealed that 1 L of the oil contains 3.67±0.59mg of sodium, 2.33±0.59mg of potassium, 1.50±0.03mg of calcium, 0.28±0.03mg of magnesium, 0.17±0.06mg of manganese, 0.07±0.01mg of copper, 1.70 ±0.02mg of iron, 0.33 ±0.01mg of Zinc and 0.00mg of lead. These results showed that the Cocosnuciferaseed can be a good source of oil, and the extracted oil contains an appreciable amount of phytochemicals and mineral elements. Therefore, Justification of the use of the seed kernel oil for food, medicinal and cosmetic was expatiated.*

Keywords: *Cocosnucifera, Coconut, Physicochemical, Phytochemical, Minerals*

1. INTRODUCTION

Cocosnucifera (coconut) belongs to the family *Arecaceae*. It is widespread throughout the tropics, typically being found along sandy shorelines. It has been spread largely by man but also by natural means. The fruit can float for long distance and still germinate to form new trees after being washed ashore. Commercial plantings are confined to the tropical lowlands, but it also produces fruit in a few warmer subtropical areas [1].

The coconut palm starts fruiting 6 to 10 years after the seed germinates and reaches full production at 15 to 20 years of age. It continues to fruit until it is about 80 years old with an annual production of 50 to 200 fruits per tree. The fruits require about a year to develop and are generally produced regularly throughout the year [2].

The palm tree has a smooth, columnar, light grayish brown trunk, and topped with a terminal crown of leaves. Tall selections may attain a height of 80 to 100 feet while dwarf selections are shorter in stature. The trunk is slender and slightly swollen at the base. It is usually erect but may be leaning or curved.

The leaves are pinnate with feather-shaped, up to 18 feet long and 6 feet wide. The leaf stalks are 3 to 5 feet in length and thornless. Flowers are small, light yellow, and in clusters which emerge from canoe-shaped sheaths among the leaves.

The seed is roughly ovoid, up to 15 inches long and 12 inches wide, composed of a thick, fibrous husk surrounding a somewhat spherical nut with a hard, brittle hairy shell. The nut is 6 to 8 inches

in diameter and 10 to 12 inches long. Three sunken holes of softer tissue called "eyes" are at one end of the nut. Inside the shell is a thin, white, fleshy layer, about ½ inches thick at maturity, known as the "meat". The interior of the nut is hollow but partially filled with a watery liquid called "coconut milk". The meat is soft and jelly-like when immature but it becomes firm at maturity. The coconut milk is abundant in unripe fruits but it is gradually absorbed as ripening proceeds. The fruits are green at first turning brownish as they mature. Yellow varieties go from yellow to brown [2].

The coconut is the most extensively grown and used nut in the world and the most important palm. It is an important commercial crop in many tropical countries, contributing significantly to their economies. The chief product is copra, the source of coconut oil used for making soap, cooking oils and margarine. Much of the seed kernel is consumed locally for food.

Coconuts and the oil content are believed to be rich in various constituent by traditionalists. Although, many researchers have worked on coconut kernel oil, yet there is need for increased utilization and awareness about its health, nutritionaland industrial benefits. This research work is aimed to justify the pharmacological and nutritional attribute of the coconut kernel oil.

2. MATERIALS AND METHODS

2.1. Sampling and Sample Preparation

Figure 1. *CocosnuciferaL. Seed Kernel (White Portion)*

The coconut seeds were purchase from Ajanla farm in Ibadan, Oyo State, Nigeria and identified by a taxonomist inthe Department of Biological Sciences, Kebbi State University of Science and Technology Aliero, with the voucher number of 504 as cultivated *Cocosnucifera*(coconut). Thehard pericarp was carefully broken to obtain the kernel. The kernels werecleaned with water, and then grated, followed by the oil extraction process immediately.

2.2. Oil Extraction and Determination of Yield

The routine extraction of the oil was conducted using Soxhlet extractor with n-hexane as a solvent for 4 hours. The total amount of oil from the coconut sample was obtained by the complete distillation of the solvent on the heating mantle and transfer into a measuring cylinder. The measuring cylinder was then placed over water bath for 2-3 hours in order to evaporate completely the little solvent present in the oil.The extracted oil was stored in a cool dry place for further analyses. The percentage oil yield was calculated as below:

$$\text{Oil Content (\%)} = \frac{Weight\ of\ oil}{Weight\ of\ sample} \times 100$$

2.3. Analyses of Physicochemical Properties

The analyses of the physicochemical properties (saponification value, acid value, peroxide value, iodine value,free fatty acids, specific gravity, smell and appearance) of the oil were carried out using the methods described by Association of Official Analytical Chemist [3]. All the determinations were done in triplicates.

2.3.1. Determination of Free Fatty Acids

2.0g of the extract was transferred into 250cm^3 Erlenmeyer flask followed by the addition of 50cm^3 of n-hexane and 1cm^3 of phenolphthalein indicator. The mixture was then shaked and titrated against 0.04 M NaOH. The shaking continued until a slight pink color which was steady

for about 15 second was observed which signified the end point.The expression for free fatty acid (FFA) is as follows:

$$\%FFA = \frac{V \times M \times 282}{W} \times 100$$

Where, %FFA = Percentage free fatty acid (oleic acid), V = Average volume of NaOH used (cm^3), M = Molarity of NaOH, 282g/mol = Molecular weight of oleic acid, W = Weight of oil

2.3.2. Determination of Specific Gravity

A clean and dried density bottle with a stopper was weighed. The density bottle was then filled with cold distilled water and kept in a water bath for 30 minute at 25^0C. The weight of the bottle together with the water was taken. After weighing, the bottle was emptied and then dried in an oven for 2 minutes. The dried bottle was then filled with the oil and then weighed. The specific gravity was calculated using the formula below;

$$\text{Specific gravity} = \frac{W_2 - W_0}{W_1 - W_0}$$

Where, W_0 = Weight of empty bottle (g), W_1 = Weight of water and bottle (g), W_2 = Weight of oil and bottle (g)

2.3.3. Determination of Peroxide Value

2.0g of the oil was weighed into a clean dry flask and 22cm^3 of a mixture of 12cm^3 of chloroform and 10cm^3 of acetic acid was added. This was followed by the addition of 0.5cm^3 of potassium iodide. The flask was covered and allowed to stay with constant shaking for 1minute.After which 30cm^3 of distilled water was then added and titrated against 0.1M of sodium thiosulphate ($Na_2S_2O_3$) solution until an initial yellow color disappeared and a faint blue color appeared. 0.5cm^3 of starch indicator was added quickly with continuous titration until there was a sudden disappearance of the blue color which signifies the end point.The peroxide value was obtained by the use of the following expression;

$$\text{Peroxide Value (mEq}H_2O_2\text{/100g)} = \frac{(S - B) \times M \times 1000}{W \times 100}$$

Where, S = sample titre value (cm^3), B = Blank titre value (cm^3), M = Molarity of $Na_2S_2O_3$ solution (mEq/cm^3), 1000 = Conversion of unit (g/kg) ,W = Weight of oil sample

2.3.4. Determination of Acid Value

25cm^3 of 5% ethanol was measured into a conical flask and boiled in a water bath in order to remove dissolved gasses. 2.5g of the oil was transferred into the 25cm^3 of hot ethanol with continuous heating until the mixture boiled. After which few drops of 1% phenolphthalein indicator were added and titrated against 0.1M KOH. The shaking continued until a permanent pink color appeared which signified the end point.Acid value is expressed as follows:

$$\text{Acid value (mgKOH/g)} = \frac{56.1 \times M \times V}{W}$$

Where, M = Concentration of KOH, V = Titre value (cm^3), 56.1 = Molecular weight of KOH (g), W = Weight of oil sample (g)

2.3.5. Determination of Iodine Value

0.4g of the extract was weighed into conical flask and then dissolved by the addition of 20cm^3 of carbon tetrachloride. After which, 25cm^3 of wij's reagent was added with the help of a safety pipette in a flame chamber. A stopper was inserted and the mixture was swirled vigorously before it was then placed in a dark room for 2.5 hours. At the end of this period, 20cm^3 of potassium iodide and 125cm^3 of water was added with the use of a measuring cylinder. The resulting solution was then titrated with 0.1M sodium thiosulphate solution until the initial yellow color almost disappeared. Few drops of 1% starch indicator was then added with few drops of thiosulphate added wisely as the titration continued with rigorous shaking until the blue coloration disappeared. The same procedure was carried out for the blank.To calculate the iodine value, the following expression was used:

Iodine Value ($gI_2/100g$) = $\frac{12.69\times C\times (V_1-V_2)}{W}$

Where, C = Concentration of Sodium thiosulphate, V_1= Volume of sodium thiosulphate used for blank, V_2 = Volume of sodium thiosulphate used for test, W = Weight of sample.

2.3.6. Determination of Saponification Value

2.0g of the oil was added into a clean dried flask containing 25ml of ethanolic potassium hydroxide solution. A reflux condenser was attached and the flask was heated in boiling water for 1 hour with continuous shaking to ensure that the sample was fully dissolved. After leaving the sample to cool, 1ml of phenolphthalein (1%) solution was added and titrated against 0.5M HCl until a pink coloration disappeared which signified the end point. The saponification value was calculated by using of the expression below:

Saponification Value (mgKOH/g) = $\frac{(S-B)\times M\times 56.1}{\text{weight of oil sample (g)}}$

Where, S = Sample titre value (ml), B = Blank titre value (ml), M = Molarity of HCl, 56.1 = Molecular weight of KOH

2.4. Qualitative Phytochemical Screening

2.4.1. Test for Flavonoids

2ml of 10% sodium hydroxide was added to 2ml of the oil extract in a test tube. A yellow color was formed which turned colorless upon addition of 2ml of diluted hydrochloric acid indicating a positive result [4].

2.4.2. Test for Phenol

2ml of the oil extract was mixed with few drop of 10% ferric chloride solution. The formation of green-blue or violet or blue-black coloration was an indication of a positive result [4].

2.4.3. Test for Tannins

5 drops of 0.1% ferric chloride was added to 2ml of the oil extract, formation of a brownish green or blue-black colouration indicates a positive result [5].

2.4.4. Test for Saponins

2ml of oil extract was diluted with 2ml distilled water. It was then agitated in a test tube for 5minutes. 0.1cm layer of foam indicates a positive result [6].

2.4.5. Test for Phlobatannins

2ml of the oil extract was boiled with 1% aqueous hydrochloride. Deposition of a red precipitate indicates a positive result [7].

2.4.6. Test for Alkaloids

To2ml ofthe oil**,** 2ml of 10% hydrochloric acid was added. To the acidic medium, 1ml Hager's reagent (saturated picric acid solution) was added. Presence of alkaloids is confirmed by the formation of yellow colored precipitate.

2.4.7. Test for Steroids

2ml of the oil was dissolved in 10ml of chloroform and then, 10ml of concentrated sulphuric acid was added by the side of the test tube. The upper layer turned red whereas, the sulphuric acid layer turned yellow with green fluorescence. This indicates the presence of steroids [6].

2.4.8. Test for Terpenoids

2ml of the oil was mixed with 2ml of chloroform and 1ml of concentrated sulphuric acid was carefully added to form a layer. Clear upper and lower layers with a reddish brown interphase indicate a positive result [6].

2.4.9. Test for Glycosides

2ml of acetic acid was added to 2ml extract. The mixture was cooled in a cold water bath. 2ml of concentrated H_2SO_4 was added. Colour development from blue to bluish green indicates the presence of glycosides [5].

2.4.10. Test for Anthraquinones

2ml of the oil extract was boiled with 5ml of 10% hydrochloric acid for 3 minutes. 5ml of chloroform was added. 5 drops of 10% ammonia was further added. A rose pink coloration indicates a positive result [8].

2.5. Quantitative Phytochemical Screening

2.5.1. Determination of Alkaloids Content

The total alkaloid content was measured using the method described by [8]. 5g of the oil extract was weighed into a 250 mL beaker and 100 mL of 20% acetic acid in ethanol was added and covered to stand for 2 hours. This was filtered and the extract was concentrated using a water bath to one quarter of the original volume. Concentrated ammonium hydroxide was added drop wise to the extract until the precipitation was complete. The whole solution was allowed to settle and the precipitate was collected by filtration and weighed. All samples were analyzed in triplicates.

$$\text{Alkaloid (mg/g)} = \frac{\text{Weight of residue}}{\text{Weight of sample}}$$

2.5.2. Determination of Flavonoids Content

The total flavonoid content was determined using the method of [9]. 2.5 g of the oil extract was mixed with 25 mL of 80% aqueous methanol. The whole solution was filtered through the whatman filter paper. The filtrate was transferred to a crucible and evaporated into dryness over a water bath and weighed. All samples were analyzed in triplicates.

$$\text{Flavonoid (mg/g)} = \frac{\text{Weight of residue}}{\text{Weight of sample}}$$

2.5.3. Determination of Saponins Content

This was measured using the method of [10]. 5 g of the oil extract was introduced into a conical flask and 25 mL of 20% aqueous ethanol was added. The sample was heated over a water bath for 1 hour with continuous stirring at about 55^{o}C. The concentrate was transferred into a 250 mL separating funnel and 5mL of diethyl ether was added and shaken vigorously. The aqueous layer was recovered while the ether layer was discarded.15 mL of n-butanol was added, and then 2.5 mL of 5% aqueous sodium chloride was added. The remaining solution was heated over a water bath. After evaporation, the sample was dried in the oven to a constant weight. All samples were analyzed in triplicates.

$$\text{Saponins (mg/g)} = \frac{\text{Weight of residue}}{\text{Weight of sample}}$$

2.6. Determination of Mineral Elements by Wet Digest Method

The elements were extracted from the oil by the wet digest method [11]. The digested sample was analyzed for the elemental composition using Atomic Absorption Spectrophotometer (AAS). Zn, Pb, Fe, Mn,Cu, Mg, Na, K and Ca were determined and the concentrations of the elements were presented in mg/L.

3. RESULT AND DISCUSSION

The results of the Physicochemical Properties are presented in Table 3, while those of Phytochemical and Mineral Composition are presented in Table 4 and 5 respectively.

Table 1. *Physicochemical Properties of CocosnuciferaL. Kernel Oil*

Parameter	Observation/Result
Appearance	Clear white
Smell	Nutty
Stateat room temperature	Liquid
Percentage yield (%)	21.61
Specific gravity (g)	0.95±0.05
Iodine value (gI_2/100g)	46.8±0.63
Acid value (mgKOH/g)	0.79±0.21
%Free fatty acid (oleic acid)	20.49±1.46
Peroxide value ($mEqH_2O_2$)	10.00±5.00
Saponification value (mgKOH/g)	7.74±0.73

Values are presented as mean ± standard deviation of triplicates.

Table 2. *Phytochemical Composition of CocosnuciferaL.Oil.*

Phytochemical	Observations	Concentrations (mg/g)
Flavoniods	+	0.23±0.08
Phenols	-	-
Tannins	-	-
Saponnins	+	0.03±0.01
Phlobatanins	-	-
Alkaloids	+	0.11±0.01
Steriods	+	NQ
Terpenoids	+	NQ
Cardiac glycosides	-	-
Anthraquinones	-	-

+ = Present, ─ = Not Detected,NQ = Not Quantified

Table 3. *Mineral Composition of Cocosnucifera L. Oil*

Element	Concentration (mg/L)
Sodium (Na)	3.67±0.59
Potassium (K)	2.33±0.59
Calcium (Ca)	1.50±0.03
Magnesium (Mg)	0.28±0.03
Manganese (Mn)	0.17±0.06
Lead (pb)	-
Copper (Cu)	0.07±0.01
Iron (Fe)	1.70±0.02
Zinc(Zn)	0.33±0.01

Values are presented as mean±standard deviation of triplicates. - = Not Detected

According to this research work, the percentage yield of*Cocosnucifera L.* (Coconut)seed oil was observed to be 21.61% which is lower compared to the value obtained by [2]. The physicochemical analysis of the coconut seed oil showed that it has saponification value of 7.73 ± 0.73 mgKOH/g which is lower than the saponification values of the following seed oils; *Citrus lanatus*189.35mgKOH/g [12], *Adansoniadigitata*Linn 230.01 mg KOH/g [13], *Elaeisguineensis* 246.60 mg KOH/g [14]. Iodine value was 46.8 ± 0.63gI_2/100g which is lower compared to those of the following oils: *Hypertisspicigera*seed oil 81.22gI_2/100g [15]and *Landolphiaowariensis*seed oil 0.10I_2/100g [14]. Oils with iodine value below 100 are non-drying oils [16].

Acid value serves as an indicator for edibility of oil. It is the mg KOH required to neutralize the free fatty acid in 1g of oil. The acid value is used to measure the extent at which glycerides in oil are decomposed by lipases and other actions such as light and heat and that its determination is often used as general indication of the condition and edibility of oils [17]. In general, the lower the acid value the more its acceptability for edibility purpose. The acid value of this oil sample is 0.79±0.21mgKOH/g, which is acceptable for edible purposes since it is slightly low.

Peroxide value is a measure of oxidative rancidity of oil. Oxidative rancidity is the addition of oxygen across the double bonds in unsaturated fatty acids in the presence of enzymes or certain chemical compounds. High peroxide values are associated with higher rate of rancidity. The value obtained in this work (10.0 ± 5.0 mgH_2O_2)which indicates that the coconutseed oil has high chance of becoming rancid, and the value 10.0 ± 5.0 mgH_2O_2 is also higher than that obtained and reported earlier by [18] (0.32 0.12mEq H_2O_2).

Free fatty acid content is the amount of free acids present per gram of the sample. The percentage of free fatty acids obtained from the result is 2049.2 ± 146.63 , this shows that the higher the amount of fatty acid present in the oil, the higher the smoke, flash and fire point of the oil. High percentage of free fatty acids in crude oil is undesirable because they result in high losses of neutral oil during refining. In crude fat, free fatty acids estimate the amount of oil that can be lost during refining steps to remove the fatty acids. Evidence from epidemiological studies also suggested that the presence of a high proportion of monounsaturated acid especially oleic acid in the diet is linked with a high reduction in the risk of coronary heart disease. High quality oils are low in free fatty acids [3]. The free fatty acid value of this oil is very high compared to that earlier reported by [18]which was (4.48 ± 0.44).

The results of the qualitative phytochemical screening of the oil extract indicate that saponnins, alkaloids, terpenoids, flavonoids and steriods are present in moderately high concentration while phenols, cardic glycosides, tannis, phlobatannis, anthraquinones are absent.

The result of the quantitative phytochemical analysis of alkaloid, saponnins and flavonoids were 0.11 ± 0.01mg/g, 0.03 ± 0.01mg/g, 0.23 ± 0.08mg/g respectively.

The presence of terpenoids and steroids concentration in the coconut seed oil may be related to their non-polar nature which obviously favors their increased concentration in the oil [19]. The absence of cardiac glycosides in the oil may be related to their expected tendency to partition away from the oil due to their lipid insoluble nature [19].

From the results of the quantitative phytochemical screening, the concentration of total flavonoids is the highest with 0.23 ± 0.08mg/g, this flavonoids content indicates that the oil will be good for management of cardiovascular diseases and oxidative stress because flavonoids are potent biological antioxidants [19]. The presence of flavonoids in coconut seed oil also accounts for its antioxidant property as reported by [20], as well as its application in inhibiting replication of human colon cancer cells reported by [21]. Flavonoids also provide protection against cardiovascular diseases by contributing to the total antioxidant defense system of the human body. The natural coconutseed oil has high stability due to the presence of these natural antioxidants [21].

In this research, the second abundant phytochemical in the coconutseed oil was alkaloid with a concentration of 0.11 ± 0.01mg/g. Alkaloids have been used as central nervous system stimulants, topical anesthetics in ophthalmology, powerful pain relievers, anti-puretic action, among other uses, as such the use of this oil can serve these purposes.

From the result, it was observed that the analyzed coconutseed oil has a saponins concentration of 0.03 ± 0.01mg/g. The presence of saponins in the oil accounts for its use in maintaining high density lipoprotein cholesterol (HDL-C) levels and lower low density lipoprotein cholesterol (LDL-C) levels as reported by [22]. Saponins aid in reducing cholesterol levels by forming complexes with cholesterol and bile acids which prevent them from being absorbed through the small intestine hence lowers the cholesterol level in the blood and liver. The presence of saponins in the oil may account for its use as an anti-cancer agent as reported by [21]. Saponins also serve as antioxidants as they prevent degeneration of DNA and also help to reduce colon damage and risk of cancer. According to [23], saponins are used as adjuvants in vaccines and then oral intake has been used to help in managing retroviral infections. Also saponins stimulate antibody production, inhibit viruses and induce the response of lymphocytes which are white blood cells that fight infection [23]. So, the presence of saponins in the coconutseed oil makes it to be a good immune buster.

The presence of terpenoid in theseed oil is similar to that reported [19]. Hence, the presence of terpenoids in the coconutseed oil also accounts for its use as an anti-diabetic agent as reported by [20]. Terpenoids also act as antibiotics to protect plants from pathogenic microorganisms, and they are heart-friendly phytochemical constituent which help to reduce diastolic blood pressure and lowers the sugar level in the blood [24].

The presence of steroids in coconutseed oil is similar to the reported work by [19], which also reveals a large presence of the steroids in theseed oil. Steroidal compounds are of importance and interest in pharmacy due to their relationship with compounds such as sex hormones.

The analyse of the mineral element composition of the coconutseed oil reveal the presence of zinc, iron, potassium, sodium, copper, manganese, magnesium and calcium while lead is absent. The most abundant element found in theseed oil is sodium with concentration of 3.67 ± 0.59 mg/L, sodium keeps fluids and electrolytes balanced in the body and it is essential for muscular contraction and nervous cell communication Thus, this oil is a poor source of sodium and cannot serve as a nutritional supplement since a reference range of 2300mg/day is recommended by [25].Hence the oil can be recommended for hypertensive patient. The second most abundant element in coconut seed oil is potassium with the concentration of 2.33 ± 0.59 mg/L, this oil is a poor source of potassium compared to the daily requirement of 2000-3500mg/day [25].The oil cannot serve as nutritional supplement for these element but can be recommended for hypertensive patient.

The manganese content of theseed oil is 0.17 ± 0.06mg/L. Manganese functions as a cofactor for several enzymes, such as arginase, pyruvate carboxylase, isocitrate dehydrogenase, superoxide dismutase and peptidase. Manganese is also required for the formation of bone, proper reproduction and normal functioning of the nervous system. Hence, coconutseed oil can be a good source of manganese.

The copper content of the oil is 0.07 ± 0.01 mg/L. Copper is an essential constituent of several enzymes, such as cytochrome oxidase, catalase, tyrosinase, superoxide dismutase etc. Deficiency of copper causes demineralization of bones, demyelination of neural tissue, fragility of arteries, myocardial fibrosis etc., the daily requirement of copper is 900mg/day, as such this oil is not a good source of copper [25].

Zinc concentration is 0.33 ± 0.01mg/L, therefore, this coconutoil can serve as a nutritional supplement for zinc because it has the moderate concentration that is required daily as reported by [25]. Zinc is an essential trace element which plays many biological roles.

The value of iron obtained was 1.70 ± 0.02 which indicates that the coconut seed oil is a fair source of iron since the recommended daily allowance for iron is 6-8mg/day [25].

Magnesium serve as a co-factor of many enzyme, involved in energy metabolism, protein synthesis, RNA and DNA synthesis, maintenance of electrical potential of nerve cells and cell membrane. 0.28 ± 0.03mg/L was obtained and the daily requirement of 150-500mg is needed [25], indicating that this oil is a poor source of magnesium.

Lead has not been detected in this oil, which indicates that the oil is safe for consumption.

4. CONCLUSION

The *Cocosnucifera*(coconut)seed oil can be a good source of oil because it has moderate oil content. The phytochemical constituents present in the oil are generally moderate in concentration. Therefore, this has the advantage of inferring pharmacological attributes on the oil. The oil is a good source of iron, sodium, potassium and calcium because the concentrations of these elements in the oil meet up with the adequate quantity needed by the body daily. Thus, coconutseed oil has both nutritional and pharmacological benefits and being free from lead, it is safe for human consumption.

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