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Full Length Research Paper

Fatty acids and phytochemical contents of different coconut seed flesh in Nigeria

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Some positive health benefits have currently been attributed to coconut intake. An attempt has been made to determine the fatty acids and phytochemical contents of coconut seed flesh collected from the different parts of Nigeria. The fatty acid composition was determined by gas chromatography while phytochemical content was detected using the polar and non polar solvents. The findings revealed that samples from eastern Nigeria had highest fatty acids (caprylic: 8.60±0.00%; lauric: 41.30±0.14%; palmitic: 13.00±0.14%, and stearic: 3.6±0.07%) contents. The fats and oil constituent of coconut was more of lauric acid (37.40-41.30%), a medium chain fatty acid considered to be responsible for the many health benefits attributed to coconut consumption. Both solvents used in determination of phytochemicals revealed the presence of alkaloid, resins, glycosides, terpenoids and tannins in all the Nigerian coconut samples. However, saponin was found present in coconut when polar solvent was used while Flavonoids, steroids and acidic compounds were absent with the use of both polar and non polar solvents. The detected phytochemical and beneficial fatty acids revealed that Nigerian coconut seed flesh should be regarded as one of the functional foods in our diets. Thus, the use of coconut seed flesh in our diets should be encouraged for health supporting functions.

Key words: Coconut, fatty acids, phytochemicals, functional foods.

INTRODUCTION

Coconut (*Cocos nucifera* L.) is a monocotyledon belonging to the Arecaceae family (Order Arecales) (Konan et al., 2008). In the past, clinicians, food and nutrition scientists have been unaware of the potential benefits of coconut and coconut oil. But currently, several researchers have recognized the antiviral, antibacterial, antiprotozoal and anti-cancer effects of coconut (Enig, 1998). Some of the beneficial effects of these special saturate found in coconut oil were compared with those of the unsaturates found in some of the other food oils by Enig (1998). And noted that lauric acid, and even capric acid, have been the subject of these favorable scientific health parameters. The beneficial effect of coconut consumption has also been buttressed by other researchers as follows: Kaunitz and Dayrit (1992) reported that coconut-eating groups do not have high serum cholesterol nor high coronary heart disease mortality or morbidity. Mendis and Kumarasunderam (1990) found an increase in the HDL cholesterol among the group of males on coconut oil whereas; their counterpart on soy oil had reduced levels of this desirable lipoprotein. Previously, Prior et al. (1981) had shown that islanders with high intakes of coconut oil showed "no evidence of the high saturated fat intake having a harmful effect in these populations." When these groups migrated to New Zealand, however, and lowered their intake of coconut oil, their total cholesterol and LDL cholesterol increased, and their HDL cholesterol decreased.

Approximately 50% of the fatty acid in coconut fat is lauric acid (Enig and Fallon, 1999). Lauric acid is a medium chain fatty acid that is broken down into monolaurin in the human body. Monolaurin is the active metabolite of lauric acid (Enig, 1998). Other medium chain saturated fatty acids present are: caprylic acid (9%), capric acid (8%), caproic acid (5%) and myristic acid (20%) which make up the triglyceride molecule, and form antimicrobial properties of coconut oil. The fatty acids are predominately medium chain fatty acids, having 12 carbon atoms (Lauric) and 8 carbon atoms (caprylic) (Russell and Williams, 1995). The long chain fatty acids include palmitic acid and stearic acid. The unsaturated fatty acid present includes: linoleic acid, linolenic acid

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(1-3%), arachidonic acid (0.2%) and eicosinoic acid (0.2%) (British Pharmacopoeia, 2001).

Of the saturated fatty acids, lauric acid has greater antiviral activity than caprylic acid (C-8), capric acid (C-10), or myristic acid (C-14). Beside breast milk, coconut oil is nature's most abundant source of lauric acid (Calbom and Calbom, 2005). The benefits of saturated fats as reported by Enig (1998) include: provide stiffness and integrity to cell membranes, promote the incurporation of calcium into the skeletal structure, protect the liver from alcohol and other toxins, improve the immune system, needed for the proper utilization of essential fatty acids such as omega-3 fatty acids, short- and medium-chain saturated fatty acids have important antimicrobial properties which include protection against harmful microorganisms in the digestive tract. Medium chain triglycerides taken at fairly high doses reduce blood cholesterol levels and coconut oil is nature's richest source of medium chain triglycerides (Calbom and Calbom, 2005).

Previous researches had reported that coconut oil improve insulin secretion and utilization of blood glucose due to the presence of capric and lauric acids. This forms the basis for coconut use in the management of diabetes (Enig, 1999).

Phytochemicals are substances that are not absolutely required elements of the diet but provide significant health benefits which include reduction of the risk of certain diseases such as cancer and cardio vascular diseases (Wardlaw, 2003). Some of the phytochemicals with significant health potentials include flavonoids, carotenoids, phenolic acids, saponnins, glycosides, tannins, alkaloids (Whitney and Rolfes, 2008). However, coconut has been found a typical example of plants possessing such quality (Obidoa et al., 2010).

According to Kindersley (2006), phytochemicals are plants derived compounds that can be used as therapeutic agents. They reduce the risk of cancer due to dietary fibres, polyphenols, antioxidants and anti-inflammatory effects (Kindersley, 2006). A term has been coined to refer to foods rich in phytochemicals – functional foods, which can provide health benefits beyond those supplied by the traditional nutrients they contain (Wardlaw, 2003). The review of increasing trend of atherosclerotic disease and type-2 diabetes mellitus among the Indians revealed that over the time when there has been an alarming increase in the prevalence of these diseases, there has been a replacement of traditional cooking fats with refined vegetable oils that are promoted as heart-friendly, but which are being found to be detrimental to health (Sircar and Kansra, 1998). These researchers therefore, suggest that it is time to return to the traditional cooking fats like ghee, coconut oil, and mustard oil.

The present study aimed to evaluate the fatty acids and phytochemical components of different species of coconut seed flesh found in Nigeria and probably advocate for returning to coconut incorporation in Nigerian menu.

MATERIALS AND METHODS

Procurement and preparation of samples

The coconut fruit were bought from markets in Katsina (Northern Nigeria), Lagos (Western Nigeria), Calabar (Southern Nigeria), and Umuahia (Eastern Nigeria). They were appropriately labeled. The samples were sorted, dehusked and broken with a hammer. The seed flesh was removed from the shell with a kitchen knife and cut into small pieces.

They were ground into a paste using a mechanical hand grinder. The paste was divided into 3 portions from each coconut fruit and well labeled. Some of the samples were oven dried and the rest soaked with very hot water and the milk was squeezed out and stood for 48 h to ferment. The cud that settled on top after two days was carefully collected and put in a pot and boiled for 2 h till the oil came out and was collected for analysis (Fife, 2005).

Fatty acid determination

Step 1: Lipid Extraction: The oil was extracted according to the method described by Fife (2005).

Step 2: Total Lipid Determination: The total lipid content was determined gravimetrically on an analytical scale (Mart®, precision of 0.001 g).

Step 3: Fatty Acid Identification: Aliquots of the lipid extract were esterified with BF3- methanol (Joseph and Ackman, 1992). The fatty acid composition of each aliquot was determined by gas chromatography on a 60 m fused capillary column with an internal diameter of 0.20 mm (CP Sil 88). The analysis was performed on a Hewlett- Packard 6890® gas chromatograph equipped with a flame ionization detector. Helium was used as carrier gas and nitrogen as make up gas.

The injection port temperature was 200°C and the detector temperature was 250°C. Oven temperature was ramped to 15°C for 3 min and increased to 160°C/min; it was then held at 160°C for 3 min, increased to 190°C at 1.5°C/min, and held at 190°C for 1 min. Finally, temperature was increased to 220°C at 1°C/min.

A Hewlett Packard computing integrator calculated retention times and peak area percentages. Fatty acids were identified by comparing sample retention times with standard retention times (36 saturated, monounsaturated and polyunsaturated fatty acid standards, Sigma and Polyscience, U.S.A ®). Quantification was carried out by normalization and transformation of the area percentage to mg per 100 g of edible portion, using the lipid conversion factor.

Phytochemical analysis

For the phytochemical analysis the extraction method was used with both polar and non polar solvent. The tests were carried out to determine the active constituents according to the procedures and method outlined by Harborne (1973); Trease and Evans (1983). For the water extraction (polar solvent extraction), a small quantity of milled coconut copra was extracted in cold distilled water and used for analysis.

For non polar solvent extraction, 100 g milled coconut copra was soaked in 500 ml n- hexane for 24 h and filtered. The filtrate was concentrated by heating in a water bath at 60°C to evaporate the n-hexane giving a semi-solid extract which was used for analysis.

These phytochemical tests were done to detect the presence of secondary metabolites such as Alkaloids, tannins, saponins,

Table 1. Fatty acid content of the coconut samples.

Samples	Caprylic %±SD	Lauric %±SD	Palmitic %±SD	Stearic %±SD	Oleic %±SD
West	8.10^{b}±0.14	37.40^{c}±0.28	13.30^{b}±0.00	3.20±0.20	3.90±0.00
East	8.60^{a}±0.00	41.30^{a}±0.14	13.00^{b}±0.14	3.6^{b}±0.07	4.20±0.28
South	7.50^{c}±0.14	38.40^{b}±0.00	12.12^{c}±0.02	3.40±0.07	4.40±0.14
North	7.85^{c}±0.59	38.10^{b}±0.00	12.10^{c}±0.57	3.20±0.14	4.20±0.00

*For caprylic, lauric and palmitic fatty acids P<0.05; Mean with different superscripts are significantly different.
*For stearic and oleic fatty acids P>0.05: Mean without superscripts are not significantly different

flavonoids, steroid, glycosides and terpenoids in the coconut seed flesh (Harborne, 1973; Trease and Evans, 1983).

1. Alkaloids: 2 g of each sample was boiled with 5 ml of 2% HCl in a steam bath. The mixture was filtered and 1 ml of the filtrate was measured into four test tubes. Each was tested with Dragendorff's reagents, Mayers reagent, Wagners reagent, Picric acid (1%). The various color changes as seen in the result indicated the presence and level of intensity of alkaloids.

2. Flavonoids: 2 g of each sample extract was heated with 10 ml of ethylacetate in boiling water for 3 min. The mixture was filtered and filtrates used for: (i) Ammonum test (ii) Aluminum chloride tests. The various colour changes as seen in the result indicated the presence or absence or level of intensity of alkaloids.

3. Glycosides: 5 ml of dilute sulphuric was added to 0.1 g of each sample extract and boiled for 15 min in a water bath. It was cooled and neutralized with 20% potassium hydroxide solution (KOH). A mixture, 10 ml of equal parts of Fehling's solution A and B was added and boiled for 5 min. The colour change as seen in the result indicated the presence, absence or intensity.

4. Saponnins: The emulsion and frothing tests were carried out. For the emulsion test, 2 drops of olive oil was added to 1 ml of each filtrate. The mixture was added another 2 drops of olive oil, shaken and observed for emulsion. For the frothing test, 1 ml of sample was diluted with 4 ml of distilled water; the mixture was shaken vigorously and observed on standing for a stable froth.

5. Resins: The precipitate and colour tests were carried out. 2 g of each extract was treated with 15 ml of 96% ethanol. The alcoholic extract was poured into 20 ml of distilled water in a beaker. A precipitate occurring indicated the presence of resins. For the colour test, 0.12 g of each extract was treated with chloroform and concentrated to dryness, residues were redissolved in 3 ml of acetone and 3 ml of Conc. HCl added. The mixture was heated in a water bath for 30 min. Colour change indicated the presence or absence as shown in the test result.

6. Tannins: 2 g of each sample (polar and non polar solvents were boiled with 5 ml of 45% ethanol for 5 min. Each of the mixtures was cooled and filtered. The filtrates were subjected to the following tests: (i) lead subacetate test and (ii) Ferric chloride test. The result indicated presence and the intensity of tannins or the absence of tannins.

7. Steroids and terpenoids: 9 ml of ethanol was added to 1 g of each extract and refluxed for a few minutes and filtered. Each of the filtrates was concentrated to 2.5 ml in a boiling water bath. 5 ml of distilled water was added to each of the concentrated solutions, each of the mixture was allowed to stand for 1 hr and the waxy matter was filtered off. Each of the filtrates was extracted with 2.5 ml of chloroform using a separating funnel. To 0.5 ml of each extract, 1 ml conc. H_2SO_4 was carefully added. To another 0.5 ml of extract, it was evaporated to dryness on a water bath and heated with 3 ml of conc. H_2SO_4 for 10 min in a water bath. The colour changes in both tests indicated the presence, absence and intensity of steroids and terpenoids (Harborne, 1973; Trease and Evans, 1983).

8. Acidic compounds: Blue litmus paper was used to test the extracts. Colour changes indicated the presence or absence of the compounds (Harborne, 1973; Trease and Evans, 1983).

Statistical analysis

Data was coded using SPSS version 15 (Statistical Package for Social Sciences). Analysis of variance (ANOVA) was used in the test while the Duncan test was used to determine level of significance in difference among the various samples.

RESULTS

Table 1 showed the various fatty acids detected in the coconut samples.

Caprylic fatty acids

The caprylic fatty acid varied from 7.5 to 8.6%. The sample from the East had the highest value (8.6±0.0%), followed by the western (8.1±0.14%) while the samples from the South and North were statistically the same with values of 7.5±0.14% and 7.85±0.59% respectively.

Lauric fatty acids

The lauric component was the highest among other fatty acids in the coconut samples. It ranges from 37.40 to 41.30%. The sample from the East had the highest value of lauric acid (41.30±0.14%). There was no difference (P>0.05) between the samples from the South and North while the sample from the West had the lowest value (37.40±0.28%) of lauric acids.

Palmitic, stearic and oleic fatty acids

The palmitic fatty acids content in these Nigerian coconut samples ranged from 12.10±0.57% to13.30±0.00% while stearic fatty acids ranged from 3.2±0.20% to 3.6± 0.07% and oleic fatty acids from 3.9±0.00% to 4.4±0.14%.

There was no differences (P>0.05) among these samples in stearic and oleic fatty acids con-tents. In palmitic fatty acid contents, only sample from the East was significantly higher than samples from southern and

Table 2. Phytochemical contents of coconut samples in Nigeria using polar solvent (Water).

Test	Observation	Inference	Intensity in samples			
1) Alkaloids			**WN**	**EN**	**SN**	**NN**
a) Dragendorff reagent	Brick red precipitate	Alkaloids present	++	++	++	+++
(b)Mayers reagent	Milk precipitate	Alkaloids present	++	++	++	+++
(c)Wagner's reagent	Redish brown precipitate	Alkaloids present	++	++	++	+++
(d)Picric acid test	Yellow precipitate	Alkaloids present	++	++	++	+++
2) Flavonoids						
(a) Ammounum test	No colour change	Flavonoids absent	-	-	-	-
(b) Aluminum chloride test	No colour change	Flavonoids absent	-	-	-	-
3) Glycosides	Presence of dense breck red precipitate	Glycosides present	+	+++	++	+++
4) Saponins						
(a) Emulsion test	Emulsion formed	Presence of saponins	++	++	++	++
(b)Frothing test	Formation of stable froth	Presence of saponins	++	++	++	++
5) Resin						
(a) Precipate test	Precipitate formed at the bottom of test tube	Presence of resins	++	++	++	+++
(b) Colour test	A light pink colour	Presence of resins	++	++	++	+++
6) Tannins						
(a) Ferric chloride test	Presence of cream gelatinous precipitate	Tannins present	++	++	++	++
(b) Ferric chloride test	A light green coloration which changed shortly to black was observed	Tannins present	++	++	++	++
7) Steroids						
Conc H_2SO_4 test	A reddish and brown interface was observed	Steroids absent	-	-	-	-
8) Terpeniods						
Conc H_2SO_4 test	A grey coloration was observed	Terpenoids present	++	++	++	+++
9) Acidic compounds	No change was observed on the blue litmus paper	Acidic compounds absent	-	-	-	-

Absent; + present in low concentration; ++ present in moderate concentration; +++ present in high concentration
WN = Coconut extract from Western Nigeria, EN = Coconut extract From Eastern Nigeria. SN = Coconut extract From Southern Nigeria, NN = Coconut extract From Northern Nigeria.

northern Nigeria.

The phytochemical contents of these coconut samples as detected with the use of polar solvent (water) was shown in Table 2, while Table 3 revealed the phytochemical presences using non polar solvent extract (Hexane).

Table 3. Phytochemical contents of coconut samples in Nigeria using non polar solvent extract (Hexane).

Test	Observation	Inference	Intensity in samples			
1) Alkaloids			WN	EN	SN	NN
a) Picric Acid test	Light yellow precipitate	Alkaloids present	++	++	++	+++
(b) Mayers reagent	Presence of milky precipitate	Alkaloids present	++	++	++	+++
(c) Dragendorff reagent	Brick red precipitate was observed	Alkaloids present	++	++	++	+++
(d) Wagners reagent	Reddish brown precipitate was observed	Alkaloids present	++	++	++	+++
2) Flavonoids						
(a) Aluminum test	No colour change	Flavonoids absent	-	-	-	-
3) Glycosides	dense red precipitate	Glycosides present	+	+++	++	+++
4) Saponins						
(a) Emulsion test	Emulsion formed	Saponnins saponins	-	-	-	-
(b) Frothing test	A stable froth was observed	Saponnins saponins	-	-	-	-
5) Resin						
(a) Precipitate test	Precipitate present	Resins Presence	+	+	++	+++
(b) Colour test	A light pink colour that changed shortly was observed	resins Presence	+	+++	++	+++
6) Tannins						
(a)Lead sub acetate test	A white gelatinous precipitate	Tannins absent	++	++	++	++
(b) Ferric chloride test	A light green coloration which changed shortly to black was observed	Tannins present	-	-	-	-
7) Steroids						
(a) Conc. H_2SO_4 test	Brownish red coloration at the interface	Steroids absent	-	-	-	-
8) Terpeniods						
(a) Conc. H_2SO_4 test	Presence of a grey colour	Terpenoids present	++	++	++	+++
9) Acidic compounds	No change in colour of blue litmus	Acidic compounds absent	-	-	-	-

Absent; + Present in low concentration; ++ present in moderate concentration; +++ present in high concentration.
WN = Coconut extract from Western Nigeria; EN = Coconut extract From Eastern Nigeria. SN = Coconut extract From Southern Nigeria; NN = Coconut extract From Northern Nigeria

Alkaloid

For both polar and non polar solvents, alkaloid was present in all the Nigerian coconut samples. It was present in moderate concentration in all the samples. High concentration was detected in the sample from Northern Nigeria.

Glycosides

With the polar solvent extract, glycosides were present in various degrees of intensity, namely, low concentration in the sample from western Nigeria; high concentration in eastern and northern Nigerian samples and moderate concentration in southern Nigerian sample.

Saponins

Polar solvent extract determination showed that all the samples contain saponins in moderate

concentrations, whereas non polar solvent revealed absence of saponins.

Resins

With the polar solvent extract, the samples from western Nigeria, eastern Nigeria and southern Nigeria revealed the presence of resins in moderate concentration while the sample from northern Nigeria showed a high concentration of resins. The non polar solvent extraction showed different degrees of concentration for the 2 different tests. In the precipitate test, the samples from western and eastern Nigeria showed the presence in low concentration while the other 2 samples showed the presence in moderate concentration. For the colour test, it was present in low concentration in the sample from western Nigeria, present in high concentration in the sample from eastern and northern Nigeria and present in moderate concentration in the sample from southern Nigeria.

Tannins

Using the polar solvent extract, all the four Nigerian samples revealed the presence of tannins in moderate concentrations while the use of non poplar solvent extract showed absence of tannins.

Steroids

There was absence of steroids content in all the coconut samples using both the polar and non polar solvents.

Terpenoids

Using the polar and non polar solvent extract, the results were consistent as the samples from western Nigeria, eastern Nigeria and southern Nigeria all revealed the presence of terpenoids in moderate concentration while there was high concentration in the sample from Northern Nigeria.

Flavonoids and acidic compounds

Acidic compounds as well as flavonoids were absent in all the coconut samples using both polar and non polar solvent assay.

DISCUSSION

The level of caprylic fatty acid found in these samples (7.5 to 8.6%) is similar to the 9% reported by British Pharmacopoeia (2001). However, the content of caprylic fatty acid in the sample from Northern Nigeria (7.85 ± 0.59%) is the same with that (7.8%) found in American sample (Fife, 2005). Caprylic fatty acid is one of the medium chain fatty acids. These fatty acids have antimicrobial properties; they protect us from viruses, yeasts and pathogenic bacteria in the gut. They do not need to be acted on by the bile salts but are directly absorbed for quick energy. However, Enig (1998) reported that capric acid has been identified as one of the beneficial saturated fatty acids in coconut, because of their recognized antiviral, antibacterial, antiprotozoal and anti-cancer effects.

The finding of lauric fatty acid content as the highest fatty acid component (37.40% to 41.30%) in the coconut samples agrees with Enig and Fallon (1999) , who reported that lauric acid was the major fatty acid in coconut; it was approximately 50% of all fatty acids in coconut and had greater antiviral activity than other saturated fatty acids. Calbom and Calbom (2005) stated that beside breastmilk, coconut oil is nature's most abundant source of lauric acid.

The values of lauric fatty acids in these Nigerian samples (37.40 to 41.30%) were lower than the value reported for the American sample, 47.5% (Fife, 2005). The presence of coconut lauric fatty acid in Nigerian samples revealed that Nigerian coconut seed flesh is a functional food. This is because lauric acid, a medium chain fatty acid, has additional beneficial function of being converted to monolaurin in the human body. Moreover, monolaurin is the antifungal, antibacterial, antiprotozoal and antiviral monoglyceride formed from metabolism of lauric acid (Fife, 2000). Lauric acid and capric acid have been recognized with very potent effects on insulin secretion (Enig, 1999).

Palmitic acid, oleic and stearic acid are long chain fatty acids in coconut (British Pharmacopoeia (2001). Long-chain fatty acids have from 14 to 18 carbon atoms and can be saturated, monounsaturated or polyunsaturated. Oleic acid is a mono-unsaturated omega-9 fatty acid, it has 18-carbon monounsaturated fat which is the chief component of olive oil. Palmitic fatty acid is also mono-unsaturated fat with 16-carbon and strong antimicrobial properties. However, stearic acid is an 18-carbon saturated fatty acid.

The presence of various phytochemicals in these Nigerian samples revealed the potentials of coconut as a functional food. The alkaloids content found in this study is similar with the findings of Obidoa et al. (2010), particularly to sample from the north of Nigeria. Obidoa et al. (2010) evaluated coconut samples collected from eastern part of Nigerian. Alkaloid is a bioactive constituent of plants that is responsible for the medicinal value of the respective plant foods (Edeoga et al., 2005).

In the study of Obidoa et al. (2010), moderate concentration of glycosides was found in their samples whereas our study reported high concentration in samples from

eastern Nigeria. Glycosides play numerous important roles in living organisms. Many plants store chemicals in the form of inactive glycosides. These can be activated by enzyme hydrolysis, which causes the sugar to be broken off, making the chemical available for use. Many such plant glycosides are used as medications. In animals (including humans) poisons are often bound to sugar molecules as part of their elimination from the body (Brito-Anas, 2007).

The presence of saponins in moderate concentration is consistent with the report of Obidoa et al. (2010), where moderate concentration of saponins was indicated in their coconut samples. Saponin is one of the antinutrients commonly found in plant foods to have both adverse effects and health benefits. However, saponins have also been shown to reduce blood glucose and insulin responses to starchy foods and/or the plasma cholesterol and triglycerides. In addition, saponins have been related to reduced cancer risk (Thompson, 1993). The presence of saponins in the samples could imply that consumption of coconut has the potential to lower cholesterol levels in humans due to the hypocholesterolemic effect of saponins (Osagie, 1998).

The absence of steroids in these studied samples implies that Nigerian coconut seed flesh is not a good dietary source of steroids. However, the study by Obidoa et al. (2010) detected very low content of steroids in coconut samples from Nsukka, Eastern Nigeria. Acidic compounds as well as flavonoids were also found absent in all samples in our study using both polar and non polar solvent assay which agrees with the study of Obidoa et al. (2010). This implies that coconut seed flesh is not a dietary source of flavonoid and acidic compounds.

This study observed the presence of terpenoids in moderate and high concentration while low concentration was detected in a previous study in eastern Nigeria Obidoa et al. (2010). The presence of terpenoids in the coconut samples affirms their antioxidant properties. These antioxidants are compounds that reduce the formation of free radicals or they react with and neutralize them thus potentially protecting the cell from oxidative damage (Dichter and Delanty, 2000). The presence of the phenolic compounds confirms the use of coconut to fight artherosclerosis and to inhibit the growth of cancer cells (Sabir et al., 2003).

Conclusion

This study has shown that the different samples of coconut seed flesh in the North, South, East and West of Nigeria are rich in beneficial saturated fatty acids and phytochemicals. Phytochemicals aid in protecting the body by decreasing the risk of heart diseases and certain types of cancer by the action of the antioxidants in mopping up free radicals in the body. Although coconut fat content was predominately saturated fat, the healthy fatty acids, particularly lauric and caprylic acid, help in protecting against heart disease, improving insulin secretion and utilization of blood glucose as well as reducing the risk of cancers and cardiovascular diseases. Thus, the utilization of coconut should be promoted as a functional food in Nigeria.

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