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Phytochemical and Proximate Composition of Seeds and Endocarp of Lemon *(Citrus Limon)*

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ABSTRACT

Proximate analysis and phytochemical screening were conducted on endocarp and seeds of *Citrus limon* (lemon) using analytical methods. During the study, parameters such as moisture, ash, protein, fibre, crude fat, and carbohydrates were all assessed. The result obtained for seeds shows that, moisture content is (5. 20 ± 0.85) %, ash (5. 80 ± 0.68) % fibre (0.80 ± 0. 36) %, crude fat (4. 60 ± 0. 84) %, crude protein (15. 10 ± 0.77) % and carbohydrate content (76.00 ± 0.70) %, phytochemicals like alkaloids, tannins, saponins, cardiac glycosides, flavonoids, phlobatannins, polypenols, anthraquinones, anthranoids and reducing compounds were also assessed. The result obtained from the seeds shows that Cardiac glycosides were present in large amount for petroleum ether and was present in moderate amount for water extract. Polyphenols were in excess for both water and petroleum ether extract. Polyphenols were in excess for both water and petroleum ether extract while other phytochemicals were absent. For endocarp, the result obtained shows that cardiac glycosides were moderate in petroleum ether extract and was in large amount for water extract. While polyphenols were present in excess for petroleum ether and were moderate in water extract.

Key words: Phytochemicals, polyphenols, proximate analysis, citrus limon, reducing sugar, cardiac glycosides

INTRODUCTION

It can be seen in nature that plants constitute the major aspects of the Earth crust, with each plant serving a unique function to the sustenance of the which cannot be overemphasized, the plant kingdom has proven to be the most useful for the treatment of diseases, and they provide an important source of all the world's pharmaceuticals (Ajayi et al., 2011). Lemon *(Citrus Limon)* is a specie of small evergreen tree in the Flowering plant family Rutaceae, native to Asia the tree's ellipsoidal yellow fruit is used for culinary and non-culinary purpose through the world, primarily for its juice which has both culinary and cleaning uses. The juice of the lemon is about 5%-6% citric acid. With a ph of around 2.2, give it a sour taste. Lemon is known for its distinctive quality and value in virtually all facts of life linked with medicine, food, or nutrition. All parts of lemon are useful and have high potency in the treatment of some ailments. Its juice is used in reducing fever and blood pressure (Ijege et all 2023). Studies show that the genetic origin is reported to be hybrid between bitter orange (sour orange) and citron (Gulsen & Roose, 2001) as cleaning agent, the juice of the lemon may be used for cleaning. A halved lemon dipped in salt or baking powder is used to brighten copper cook ware. As a sanitary kitchen deodorizer, the juice can deodorize, remove grease, bleach stain, and disinfect. When mixed with baking soda, it's also removing stain from plastic food storage containers. Medically, lemon is primarily important for its vitamin C and potassium content. Epidemiological studies associate the intake of citrus fruit with a reduction in the risk of various diseases. Example scurvy. (Manners, 2007). Lemon has also been used externally for acne, fungus (ringworm and athlets's foot, sunburn, and warts). Just like other citrus fruits, lemon has a significant concentration of citric acid (about 47g/I in juice) (penniston *et al.,* 2008). Other uses of lemon can be seen in lemon juice and lemon oil, where lemon oil has been evaluated for antimicrobial action. The oil shows some bacteriostic and antiviral action. Thought to be citral and linalool content. (Fisher & Phillip, 2006). Lemon has been shown to exhibit the growth of Aspergillus mold, (Ballot *et al.,* 1987). And has been used to disinfect drinking water. (Alderman et al., 19760. And to inactivate rabies. (D'Aquino et al., 1994). Many studies suggest that endogenous antioxidants or exogenous antioxidants, shuffled by diets, can function as free radicals' scavengers and improve human health. (Connor *et al* 2002). Thus, consumption of a variety of plant seeds (Lemon-seed or endocarp), provides additional health benefits. The antioxidants they contain that retard the oxidation process may additionally, exhibit antimicrobial activity (Cutter, 2000). Therefore, this study deals with the photochemical and proximate compositions of lemon (seed and endocarp) Obtain from Ikang, Akpabuyo Local Government of Cross River State. According to Beryl and Molly (1986),

The chemical composition and the nutritional constituent of the endocarp consist of carbohydrats, vitamin C, vitamin B complex, sucrose, citric acid, glucose, fructose, and minerals. Lemon pomace contains 20-30 percent pectin, this is because the substance is a byproduct of the citrus fruit juice industries, pectin extraction constitutes a profitable use of what would otherwise be waste. Pectin is extrsted from the promace and even peels of lemon, by heating them in worm water between 60 and 95^0c at carefully controlled acidity level (about pH2.5). The high acidity breaks down the insoluble pectins and allows them to dissolve in the warm water. The pectin is separated from the water by centrifugation and / or filtration. If the peeling and mashing from the juice factories are not processed immediately, they are dried to avoid natural enzymatic degradation. The seed oil from *citrus lemon* were examined from their fatty acid composition, tocopherol, and sterol contents. The oil contents of the sample varid between 32.1g/100g. The major fatty acid of the extracted seed oils was oleic (12.8-70.1%), followed by linoleum (19.5-58.5%), and politic (5.1-28.3%), Static, vaccine, lanolin and arachidic acids were found at low levels. The total content of vitamin E active compound in the oil ranged between 0.8 and 21.0mg/100g. Another sterol, campestral (8.03-15.26%). Stigma sterol (2.55-7.69%) cholestrerol (0.83-2.70%), stigmasterol (2.55-769%) cholesterol (0.83-2.70%) and cholesterol (0.93-1.78%) were detected in most of the oils (Kamel et al., 1982).

Lemons are practically never eaten alone, but their juice is used for flavoring everything from beverages to meat dishes of all the fruits, lemons are mostly used for ancillary purposes. The oil in lemon rinds is extracted for perfumes, cleaning products and deodorants (Beryl and Molly, 1986). Lemon was used as antidotes for poison and venom, in modern scientific literature, *citrus limon* show antifungal against all the mould and could be considered suitable alternatives to chemical additives for used in the food industries (Beatrz and Ramonn-laca 2004). Kumar *et al.,* (2011) reported antimicrobial activity and phytochemical analysis of citrus fruit peels utilization of fruit waste. He reported antibacterial activity of five different solvent extracts (Ethyl acetate, acetone ethanol, petroleum ether and water) prepared by soxhlet extraction from two citrus fruits *(citrus limon,* citrus sinensi were screend against five pathogenic bacteria *staphylococcus aureus, Bacillus subtilis, Escherichia coli, Klebsiella pneumonia and Salmonella typhi.* The highest antibacterial potentiality was exhibited by the acetone peel extract of citrus sinensis followed by the ethyl acetate peel extract of *citrus limon.* The extrat of both citrus fruits can be as equally potent as the antibiotics, such as metacillin and penicillin. Bioactive components. Bioactive components present in the fruits that are implicated in degenerative disease preventive include vitamin C, B-carotene, flavonoids,

limonoids, folic acid and dietary fibers. Vitamin C, flavonoids and B-carotene are potential antioxidants protecting against oxidation of biomolecules such as DNA, protein and lipid membranes, thereby reducing the risk of cancer, cataract and cardiovascular diseases. Folic acid plays an important role in amino acid metabolism and hence, it is a critical factor for growth (Jasen, 2002). Phytochemicals are large plant derived compounds hypothesized to be responsible for much of the disease protection provided by diets, high in fruits, vegetables, seed cereals and plant-based beverages such as tea and wine. The usefulness of the seed of lemon and its mesocarp can be better appreciated, if we know or have the knowledge of tts active constituents vary a lot in different plants. In some the amount be high, while in others, it may be low or completely absent. The pharmacological and medicinal properties of the seed's plants are determined by the presence and quality of these contstituents. Some of these phytochemicals are explained in subsequent sections (Bourgaud *et al.,* 2001). Alkaloids are naturally occurring chemical compounds containing basic nitrogen atoms. (Harbone, 1973). They are produced by a large variety of organisms including bacteria, fungi, plants and animals and part of the group of natural products called secondary metabolites (Farnsworth, 1996). Many alkaloids are toxic to other organisms. Also, it is important to note that alkaloids have pharmacological effects and are used as medications. for instance, morphine is a powerful narcotic used for the relief of pain, through its additive property, limits its usefulness. Codeine, the methyl ether derivative of morphine found in the opium poppy, is an excellent analgesic that is relatively non-additive. Guanidine is used for the treatment of irregular heartbeats; cocaine is a potential anesthetic and quinine cures malaria. Nicotine, obtained from tobacco, smoked in cigarettes, cigars, and pipes. Some alkaloids are illicit drugs and poisons. These includes the hallucinogenic drug like mescaline and psilocybin.

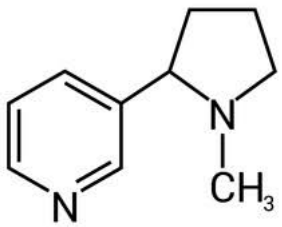

Figure 1. Structure of nicotine

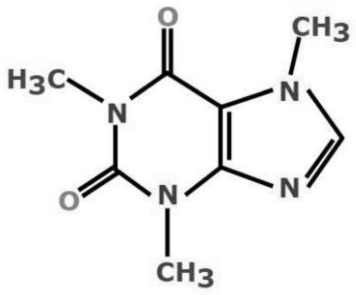

Figure 2. Structure of caffeine

Polyphenols and structural of mainly natural, but also synthetic or semi synthetic chemicals characterized by the presence of large multiples of phenol structural units. They are divided into hydrolysable tennis (gallic acid ester or glucose and other sugars) and phenyl tropanoids such as lignins, flavonoids and condensed tennis. This classification is derived from the verity of simple polyphenonolic tennis. This classification is derived from secondary plant metabolism of the shikimate pathway as well as classical division based on the importance of each base components to different field of study. Polyphones traditionally have been considered antinutrient by nutritive because of diverse effect of the tannins (a type of polyphone) on protein digestibility (Derwick, 1995). But in recent times, interest in food phenols has increased because of their antioxidant capacity and their possible beneficial effect on humans' health, like the treatment and of cancer and cardiovascular diseases. Flavoniods are polyphenolic compounds that are ubiquitous in nature and are categorized according to chemical structure into flavonols, falvones, flavonones, catching and anthoctydic (crook,2006). Over 400 flavonoids have been identified, many of which are found in fruits, vegetables, and beverages. Flavonoids have been reported to have antiviral, anti-allergic, ant platelet, anti-inflammatory, anti-tumor, and antioxidant activities (Derwick, 1995). Findings reveal a significant inverse associated between flavonoids intake and myocardial infarction (Hertzog et al., 1993). Flavonoids act favorably in the body through actions such as inhibiting xanthenes oxides and arachidonnic acid metabolism (Njveldt et al., 2001). Tannins are astringent, bitter plant polyphones that either bind precipitates or shrink proteins. This astringency, cause dry and pucker feeding in the mouth, following the consumption of red wine, unripe fruit and tea (Muller-Harvey, and Mcallan, 1992), beside engaging in usual phenolic reaction, they have properties such as ability of precipitate gelatin and other protein from aqueous media and this property has permitted, their use for conversion of raw material to animal hides to durable leather (Muller-Havey, and Mcallan, 1992). Studies by crook (2006), show that the anti-inflammatory effect of tannins, help control the indications of gastritis, irritating bowel

disorders, esophasitis, etc. it not only has burns and bleeding, but also stop infection while the wound heals internally. Condensed tannins are effective in protecting kidneys MCGee, 2004). Suguin, (1996), state that tannins found in tea and coffee may lead to iron and calcium deficiency in the body when consumed too much without milk, leading to such diseases as osteoporosis (A disease where bones become fragile) and anemia. Saponins are classes of chemical compounds found in natural sources. They are soap-like foaming they produce when shaken in aqueous solution and structurally composed of one or more hydrophilic glycoside moieties combined with lipophillic triterpene derivative (Farnsworth, 1996). They combine with bile acid to reduce blood cholesterol level in the body. They also inhibit the growth of cancer cells, and because of their antifungal and antibacterial properties, they are important in cosmetics. Cardiac glycosides are an important class of naturally occurring drugs which has both beneficial and toxic effect in the heart (Crook, 2006), throughout history, these plants, or their extract, have been used as arrow poisons, diuretics and heart tonics (Farnsworth, 1996). They are widely used in modern treatment of congestive heart failure. Cardiac glycosides work by inhibiting certain pumps hence, a rise in level of calcium ions, available for contraction of the heart muscle and so, improves the cardiac output (Ellefson, 2000). Anthraquinone is aromatic compound ($C_{14}H_8O_2$) and derivative of anthracene. It has an application of yellow or light grey-green solid crystalline powder (Ellefson, 2000). Many natural colour found in plant are because of the contraction of anthraquinone, hence it's effective use in manufacturing of dyes and in wood pulp production (Farnsworth, 1996). An example of anthraquinone is emodin. Emodin is an anthraquinone that occurs widely, in medical levels. It has valuable medicinal properties like cancer prevention by blocking the growth of transformed cells, antioxidant properties, gastric ulcer protection, liver protection, promoting blood circulation etc. (Crook, 2006). Anthranoid derivatives are used all over the world for the treatment of constipation. These compounds are present in several drug of plant origin. Antranoids include gut motility, stimulating a decrease in transit time. They also reduce fluid absorprotion and increase secretion in the colon, in the ''result'' of softer stools. (Chisel, 1995). Phlobathanins is a tannin that combines with dilute acid to yield a phobaphene, they reddish are coloured phenolic substances extracted from plant that are alcohol and water insoluble or the reddish coloured, water insoluble products result from treatment of tannin extracts with mineral acids (Chisel, 1995). Reducing sugar is any sugar that has an aldehyde group, thealdehyde function group allow the sugar to act as a reducing agent, for example in the tollen's test or Benedict's test. Reducing sugar includes all monosaccharides and most disaccharides, some examples of monosaccharides are glucose, fructose, and galactose. It is used in cellular respiration to ATP (energy of cell). Monosaccharides are source of energy, they can be converted into large

molecules which can either be store (glycogen and starch) or used as structural material (cellulose), in the Presence of CO_2, glucose and other monosaccharides can be broken to CO_2 and H_2O with the release of energy, additionally, monosaccharide sever as ‘’building blocks’’ for the formation of polysaccharides. (Janati et al., 2012). The proximate compound of citrus Limon has been analyzed by several analysts at different places and conditions respectively (all result in mean-standard deviation percentage composition). In the study by (Chuku and Nedie 2015), on the determination of proximate composition and microbal contamination of fresh juice from lemon. The result of proximate composition analysis stated that the ash content of the endocarp contains (0.5 0. ± 0.004)%, moisture contains (85.1± 0.005)%, lipid (1.15± 0.002)%, fibre (1.52 ± 0.002)%, and carbohydrates (10.61 ± 0.010)%.Farooq (2008), stated in a study of proximate0.00ssposition (%) of seeds of different citrus species and physic-chemical characteristic of lemon seeds and oil from Pakistan that, fibre content is (8.50 ±0.20)%, Ash content (5.03± 0.15)%, protein (3.90± 0.15)% and lipid (36.54± 0.36)%.Janati (2012), also evaluated the proximate composition of citrus lemon utilized in food stuffs, the result obtained was; protein (9.42± 0.63)%, fat 4.98 ±0.70)% ash (6.26± 0.59)%, fibre (15.18± 0.57)%.

MATERIALS AND METHODS

Sample Collection

The fruit samples of ***citrus Limon*** were collected from Ikang in Akpabuyo Local Government Area of Cross River, in the south-south region of Nigeria. It was the, identified by a taxonomist in Botany Department, University of Calabar.

Sample Preparation

The fruit sample was brought to the laboratory. The fruit paled, after which the seeds of the citrus Limon were separated from the endocarp. Then the samples were oven dried separated in a memmert oven at 100^{0} C temperature to remove moisture. Care was taken to avoid burning. The dried samples were then reduced into fine powder using a laboratory mill. The powder was weighed and kept away from light before extraction.

Sample Extraction

Petroleum ether and distill water were used to extract each seed and endocarp sample. In each process, 5g of the powder sample weighed and packed extractor. The sample was left in

the soxhlet extractor for three (3) hours. The petroleum ether and the water extracts obtained were put in the reagent bottles. Each was distinctively labeled and kept in the laboratory for photochemical screening.

Proximate analysis involves determination of moisture, ash, crude fibre, crude protein, fat and carbohydrates contents. Carbohydrate was calculated while ash, moisture fat, fibre and crude protein were determined.

Determination of Moisture Content

The fresh sample (5g) was taken and placed in an oven at a temperature of 100^0C for 4-5 hours. The dried samples were weighed. The weight loss was a percentage of the initial weight. The loss in weight was expressed in percentage.

Determination of Ash Content

The oven samples (5g) were weighed correctly into a porcelain crucible of known weight. The content ignited in a muffle furnace for 24 hours. The crucible and its contents were cooled at room temperature in a desiccator and reweighed.

Determination Of Crude Fiber Content

Acid digestion

The organic constituent of the insoluble matter was obtained after treating the samples with 1. 25% H_2 SO_4 and 1. 25% N_a OH respectively. For acid digestion, 5g of the samples were weighed and transferred into a 200ml beaker. 50ml of 1. 25% H_2 SO_4 Were added and the mixture was made up to 200ml with distilled water, the content of the beaker was boiled. The residue for 30 minutes with constant stirring. The residue was washed with distilled water until it was acid free.

Base digestion

The residue after acid digestion was quantitatively transferred into the 400ml beaker and 12.5ml of NaOH were added and made up to 200ml with distilled water. The mixture was heated for 30 minutes with constant stirring. The content was filtered, and residue was washed until it was base free. Finally, the residue was washed twice with methanol, and then air dried. The percentage crude fiber content was determined using the following: Weight of empty crucible =h1

Weight of empty crucible + sample + h2

Weight of empty beaker + dry fibre = h_3

$$\% \text{ crude fibre content} = \frac{h3\text{-}hi}{h2\text{-}h1} \times \frac{100}{1}$$

Determination of Crude Lipid Content

The powered materials (5g) were each weighed accurately into a previously weighted 500ml flask containing anti-bumbing chips. The sox let tractor into which the thimble with its had been introduced, was then filtered into the round bottom flask were heated, as the petroleum ether evaporated. The condensed and dropped into the thimble where its extraction process lasted for 8 hours.

The thimble was then removed and dried in an oven at 50^{o}c. The petroleum ether contained in the round bottom flask was distilled using the sox let. The small amount of the ether left in the flask and the lipid extract were finally dried in an oven 100^{o}c, cooled in a desiccator, and washed. The amount of fat was obtained from the difference between the weight of the flask before and after extraction.

$$\text{Calculation: } \% \text{ lipid} = \frac{\text{weight of lipid (g)}}{\text{Weight of sample (g)}} \times \frac{100}{1}$$

Determination of Crude Protein

The sample, 5g were accurately weighed and put into a 300ml standard Kjedahi digestion flask containing 16.0g of sodium sulphate/ copper sulphate catalyst, some anti-bumping chips and 30ml of conc. H_2SO_4. The digestion flash was placed into the digestion rack and heated gently to prevent vigorous charging and frothing. The flask and its content were then subjected to vigorous heating for about 2 hours unit a clear gigest was obtained. After digestion, the solution was cooled, then transferred quantitatively into a 100ml standard flask and made up to the mark with distilled water. 12. 5ml portion of the digest was pipette into a semi- micro kjeldahl markham distillation apparatus. 12. 5ml distilled water was added and treated with 12. 5ml of 1. 25% Na OH solution. The ammonia evolved was steam distilled into a 500ml conical flask containing 10ml solution of 4% boric acid into which 2 drops of the double indicator solution and distillation continued until about 3 time the original volume was obtained and there was a change in colour of the original content of the conical flask.The tip of the condenser was rinsed

with a few milliliters of distilled water. What remained of the 10ml digest was discarded and the flask rinsed 3 times with distilled water before the next determination. Distillate was then titrated with standard 0. 1M hydrochloric acid solution unit an end- point was reached. Distillation was carried out in triplicates for each digest and the percentage nitrogen content obtained by appropriate calculations:

$$\% \text{ Nitrogen} = \frac{14 \times 0.\text{IM HCI X liter value x dilution factor x } 100}{\text{Weight of sample x } 1000}$$

The crude protein was obtained by multiplying the percentage nitrogen content by factor 6.
25% crude protein = % N x 6.25

Determination of Carbohydrate

The carbohydrate content of the plant was determined by the difference obtained after subtracting protein, fat, ash, and fibre from total dry matter. % of available carbohydrate = 100% (protein + fat + ash + fibre).

Phytochemicals Screening

The physiochemical screening procedures carried out on the seed and endocarp of *citrus Limon* were adapted from the previous work on medicinal plant analysis. The samples were extracted with petroleum ether and water extracts to estimate the concentration of certain bioactive constituents to establish the medicinal value of the plant. Two powdered samples were carried out under close control of temperature of about 40- 60 0 C to avoid explosion for 6 hours. The final extracts were judged by the change of colour from reddish- brown to pale yellow for water extract. The yield of the residue was noted and a portion of both extracts were used to test for the underlisted plant constituents; alkaloids, flavonoids, saponnins, cardiac glycosides, phlobatannins, anthraquinones, anthranoids, reducing compounds and tennis.

Test for Cardiac Glycosides

2ml of aqueous extracts (water and petroleum ether) were separately dissolved in 2ml of chloroform. Conc. H_2SO_4 was carefully added to form a colored layer. A brown ring obtained at the interface indicates the presence of a dioxin sugar, a characteristic of cardiac glycosides. Also, there was a greenish ring and gradually spread through thus layer in petroleum ether extract showing the presence of cardiac glycosides.

Test for alkaloids

A small quantity of extract (2ml) was put in a test tube and treated with 10ml of 1% HCL and heated in a water bath for 10 minutes. 1ml of the filtrate was treated with a few drops of mayer's regent. Turbidity or the presence of alkaloids. It was absent in petroleum ether and water extract of seed and endocarp.

Test for saponins

A small amount of aqueous extract (2ml) was diluted with 10ml of distilled water in a test tube and heated in a water bath. After heating, these were shaken vigorously, the however absent in petroleum ether and water extract of the seed endocarp respectively.

Test for tannins

2ml each of the plants was stirred with 10ml of distilled water and heated in the water bath. 1ml of 1% ferric chloride (F_eCI_3) was added to the filtrate. Blue-black, or blue-green precipitation or coloration indicates the presence of tannins. But it was absent in both extracts.

Test for flavonoid

Two mls (2ml) of each of the extracts was added to a few piees of magnesium metal and concentrated HCl added. The formation of orange, red, crimson or magenta indicates the presence of flavonoids.

Test for polyphenols

The plant extract (2ml) was treated with 5ml of distilled water and heated for 30minutes in a water bath. 1ml of 1.00% F_eCI_3 was added to the mixture and followed by addition of 1.00% potassium ferrocyanids. The formation of a green-blue coloration indicates the presence of polyphenols.

Test for reducing compounds

2 ml each of the plant extract was in separate test tube and 5ml of Fehling solution added to it and heated in a water bath for 5 minutes, the formation of a brick-red precipitate or colorations indicates the presence of reducing compounds.

Test for phlobatannins

A small quantity of aqueous plants extract (2ml) was boiled with 1% HCI. The deposition of a red precipitate or coloration indicates the presence of phelobatannins.

Test for anthraniod

A small quantity of aqueous plants extract (2ml) was boiled with 5ml of HOH. The solution was filtered through glass. The filtrate was treated with 1% acetic acid and the resultant solution was mixed with toluene. The upper layer was transferred to another test tube and potassium hydroxide solution added. The presence of a red colour indicates the presence of anthranoids.

Test anthraquinones

1 ml each of plant extract was shaken with 10ml of benzene. This was filtered 5ml of 1 % NH3 solution was added. The mixture was shaken and the appearance of pink, red or violet colorations in ammoniac (lower) layer indicate the presence of anthraquinone.

RESULT AND DISCUSSION

Table I shows the result of phytochemical analysis of the seed and endocarp at *citrus limon.* The result of the phytochemical screening of citrus limon seeds and endocarp is presented in the table below:

Table 1. Phytochemical screening of *citrus limon*

S/N	Bio-active compound	Petroleum ether extract	Water extract of speed for endocarp	Petroleum ether extract of endocarp	Water extract of endocarp
1.	Cardiac glycoside	+	+	+	+
2.	Alkaloids	-	-	-	-
3.	Saponins	-	-	-	-
4.	Tannins	-	-	-	-

5.	Flavonoids	-	-	-	-
6.	Polyphenide	++	++	++	++
7.	Reducing sugar	-	-	-	-
8.	Phlobatannis	-	-	-	-
9	Anthranoid	-	-	-	-
10.	Anthraquinone	-	-	-	-

Key:

++ = present in large amount
+ = present in moderate amount
- = present

Cardiac Glycosides

The result of the photochemical screening for cardiac glycosides as recorded in Table 1 show the presence of cardiac glycoside (in large amount in petroleum ether extract and small amount in water extract for seed and have large amount in water extract and small amount in petroleum ether extract for endocarp). Cardiac glycosides leads to increase in level of calcium ion available for contraction of the heart muscle, thus improve the cardiac output and reduced failure of the heart (Lewis, et at., 2006)

Alkaloids

According to the result displayed in the table in Table 1, alkaloids are absent in both ether water extracts.

Saponins

The result of the test for saponins is presented in Table 1, but this shows absence of saponins in both water and petroleum ether extracts.

Tannins

Tannins are absent in both petroleum and water extract.

Flavonoids

Flavonoids were present in the petroleum ether extract and absent in the water extract of the endocarp (see Table 1) and were totally absent in both petroleum ether extract and water extract of the seed.

Flavonoids strengthen blood capillaries, thereby preventing small cuteanous haemontage that occur frequently in older people. They reduce cramp of the smooth muscles and improve circulation in the coronary arteries (mcgee, 200). Flavonoids also act as antioxidants it inhibits lipogenesis in cancer cells, most likely by targeting fatty acid synthase activity (Murakami et at., 2012; pengelly, 2004).

Anthration

The result shows the absence of anthranoids in the seed and endocarp extracts (Water and petroleum ether) as presented in Table1.

Polyphenols

The result of the test for polyphenol shows the presence of polyphenols in large quantities both in the petroleum ether and water extract of the endocarp. Polyphenols are important controllers of decomposition and nitrogen cycle, especially in the forest (Derwick, 1995).

Reducing compounds

The result of the phytochemical screening for reducing compounds is present in Table 1, the obtained result shows the absence of reducing agents in both petroleum either extract and water extract of the seed but shows large amount in water extract of the endocarp, this indicate little presence of the compound.

Phlobatannins

The result of phytochemical screening of *citrus limon* seed and endocarp shows the absence of phlobatannins in both the ether and water extracts.

Anthraquinones

The result of phytochemical screening for anthraquinones, as shown in Table 1, reveals that anthraquinone is absent in both ether extract and water extract respectively,

Proximate analysis

Table 2: The result of the proximate analysis of *citrus limon* (seeds and endocarp)

s/n	Parameters	Seed	Endocarp
1.	moisture content	5.20 ± 0.85	16.00 ± 0.20
2	Ash content	580 ± 0.68	5.20 ± 0.20
3.	Crude fibre content	0.80 ± 0.36	10.00 ± 0.50
4.	Crude fat content	4.60 ± 0.84	6.00 ± 0.32
5.	Crude protein content	15.10 ± 0.77	2.80 ±0.49
6.	Carbohydrate content	73.70 ± 0.86	76.00 ± 0.70

Results are presented as mean standard deviation of triplicate values.

Moisture content

The result of moisture content of seed of *citrus limon* is given in Table 2. The result obtained shows lower content of the moisture. Moisture content of food is usually used as a measure of stability, shelf life and susceptibility of microbial contamination.

Ash content

The ash content of lemon seed is given in Table 2. The seed ash content is low and makes the seed suitable for feeding meals. The knowledge of the ash content of any food is of importance in the mineral value assessment of the seeds.

Crude fiber

The analysis result for the test of crude fibre content of the seed sample is presented in Table 2. The results show that the seed fibre is low (0.80 ± 0.36), that of the endocarp is high (10.00±0.50).

Crude lipid content

The crude lipid content of lemon (seed and endocarp) as shown in table 2. is (4.60 ±0.84 and 0.32) % The lipid content of any food item helps to determine the shielf life of the food. The lipid values obtained were moderate.

Crude protein

The result of the test for protein in *citrus limon* is reported in Table 2. according to the report, there is 15.10 ± 0.77% and 2.80 ± 0.49% crude protein, for the seeds and for endocarp respectively, due to the background of cultivation. protein acids in the building and rejuvenating process in human and animal systems.

Carbohydrate content

The carbohydrate content of citrus limon is shown in Table 2, it is found to contain 73.70 ± 0.86% and 76.00 ± 0.70% for seed and endocarp respectively.

CONCLUSION

The endocarp and seed of *citrus limon (lemon)* was obtained from ikang community in Akpabuyo Local Government Area of Cross River State, Nigeria. Different chemical paramenters were investigated in the research. The result of the proximate analysis showed a very high percentage composition of carbohydrate and a moderate percentage composition of moisture and crude fibre in the endocarp There were also a moderate percentage of crude protein content in the seed and a very low percentage composition of crude fibre in the seed. The result of phytocemical screening of the endocarp showed the presence of cardiac glycosides, flovonoids and polyphenols and cardiac glycosides in water extract.While the phytochemical screening of the seed showed the presence of cardiac glycoside and polyphenols in polyphenols in water extract. While alkaloids, saponins, tannins, flavonoids, reducing compounds polyphenos and cardiac glycosides in water extract.While the phytochemical screening of the seed showed the presence of cardiac glycosides and polypheols, in water extract. While alkaloids, and polyphenols in polyphenols in water extract. While alkaloids, sapoinns, tannins, flavonoids, reducing compounds, anthranois, phlobatanins and anthraquinones were all absent. This research on th proximate and phytochemical composition of the seed and endocarp of citrus limon (lemon), has shown that it possesses very useful components such as protein, fibre, carbohydrate, and lipds to both man and animal healt such

as the flavonoids, cardiac glycoside, polyphenols, etc. For proper application of the seed and endocarp of *citrus limon* (lemon), it is necessary for further studies to be carried out on detailed study on the anti-microbial properties of *citrus limon* seeds and the endocarp, detailed pharmaceutical analysis. An isolation of the phytochemicals and determination of which classes of chemical are presented in flavonoid, polyphenol etc , their structure and description.

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