Journal of Environment and Earth Science
ISSN 2224-3216 (Paper) ISSN 2225-0948 (Online)
Vol.12, No.3, 2022

Potency of Ginger (Zingiber officinale) in Commonly Consumed Beverages. The Phytochemical and Antioxidant Approach in a Nasarawa State, Nigeria Environment

Beetseh C. I. Ph. D (Corresponding author)
Federal University of Agriculture, Makurdi (FUAM),
E-mail: igbaxclem@gmail.com

Yoo M. A. MNSE
Lower Benue River Basin Development Authority (LBRBDA), Makurdi,
E-mail: markaertoryoo@yahoo.com

Ezekiel G.
Nasarawa State University, Keffi Nasarawa State

Abstract
Zingiber officinale is a well known and widely used herb, which contains several interesting bioactive constituents and possesses health promoting properties. The phyotochemical screening and proximate composition of *Zingiber officinale* were investigated. The rhizomes of ginger were collected, treated and chopped into tiny pieces. These were dried at room temperature for 14 days and milled into fine powder using a mortar and pestle. The resulting powdered sample was subjected to phytochemical tests. The results of the phytochemical screening shows that saponins was absent in ethanol extract, present in petroleum ether extract and absent in aqueous extract, flavonoids was present at higher level in ethanol extract, moderately present in petroleum ether extract but absent in aqueous extract, tannins was present in all extracts, cardiac glycoside was present in both ethanol and petroleum extracts but absent in aqueous extract, Phlobatannins was present in all extracts, anthraquinone was highly present in ethanol extract but present in both petroleum ether and aqueous extracts however, carbohydrates, reducing sugars and combined reducing sugars were present in all extracts. Similarly, proximate analysis results obtained in percentage were average moisture content: 46.98%, ash content: 13.64%, protein content: 13.7%, fat content: 3.5% and crude fiber content: 75% values of the rhizomes. The results indicated that ginger rhizome is an excellent natural remedy for a wide range of ailments.
DOI: 10.7176/JEES/12-3-03
Publication date: March 31st 2022

1.0 Introduction

1.1 Background of the Study

According to Okwu (2004), phytochemical screening refers to the extraction, screening and identification of medicinally active substance found in plants which contribute to the colour, flavour and smell in them. In addition, they form part of plant's natural defense mechanisms against diseases. Their therapeutic values to human health and disease prevention have been reported by Okwu (2004).

Liu (2003) however reported that phytochemicals are bioactive non-nutrient compounds in fruits, vegetables, grains and other plant foods that have been linked to reductions in the risks of major non-communicable chronic diseases. McGuire (2011) added that phytochemicals is a term that refers to variety of plant-derived compound with therapeutic activities such as anticarcinogenic, antimutagenic, anti - inflammatory and antioxidant properties. They also work nutrients and fibres to form part of a plant's natural defence system against various diseases and stress conditions (Prashanth and Krishnaiah, 2014).

Zingiber officinale is a flowering plant whose rhizome, root or ginger is widely used as a spice and for medicinal purposes (Crawfort and Odle, 2005). Spices are distinguished from herbs which are part of leafy green plants used for flavouring or as garnish. Many spices have antimicrobial properties. This may explain why spices are commonly used in warmer climates which have more infectious disease and why use of spices is especially prominent in meat, which is particularly susceptible to spoilage (Fredrick, *et al.*2012).

The important active component of ginger is it volatile oil and pungent phenol compound such as gingerol, which is a very potent anti-oxidant effects, an ability to inhibit the formation of inflammatory compounds and direct anti-inflammatory effects (Thomson et al., 2002). Ginger has also been found to reduce all symptoms associated with motion sickness like dizziness, cold sweating, nausea and vomiting (Portnoi *et al.* 2003).

Zingiber Officinale (ginger) has its side effects if overdosed which include; increased bleeding tendency, abdominal discomfort, cardiac arrhythmias, heartburn and mouth to throat irritation (Crawfort and Odle. *2005).*

1.2 Statement of the Problems

This study qualitatively determined phytochemicals responsible for the medicinal properties of these spices, the problems associated with consuming it. It also determined the proximate values of these medicinal plants.

1.3 Aim and Objectives

The aim of this study is to investigate phytochemicals responsible for medicinal properties of ginger and to determine the proximate composition of ginger. However, its specific objectives are as follows;

Extraction of phytochemicals in ginger
Screening the phytochemicals
Identification of these phytochemicals
To determine proximate composition of the gingers.

1.4 Significance of the Study

This work will help the general public to know the constituents of this plant, the type of ailment the plant can heal, to know if this plant has any side effect on the consumers or not and to know the phytochemicals responsible for these side effects. The proximate analysis will help identify its nutritional and anti-nutritional contents.

1.2 Literature Review

1.2.1 History *of Zingiber officinale*

Zingiber Offleinale (ginger) is thought to have originated in Southeast Asia. It has been grown throughout tropical Asia 'since ancient time' (Sutarno *et al.* 1999). Arab traders carried it to Europe and East Africa in the 13th and 14th centuries and the Portuguese brought it to West Africa in the 16th century (Sutarno *et al.* 1999). The Spanish brought *Zingiber Officinale* (ginger) to the Carribbean and Central America in the 1500s (Sutarno *et al.* 1999).

Additional introductions have been made as countries attempted to cultivate *Zingiber Officinale* (ginger) on a larger scale (Ravindran and Babu, 2005). Plants occasionally naturalize from cultivated plants (Randall, 2012). Underground stem (rhizome) of *Zingiber Officanale* (ginger) has been used as a medicine in Asian, Indian and Arabic herbal traditions since ancient time (Attman and Marcussen, 2001). It has been used extensively for more than 2500 years in china for headache, nausea and colds (Grant and Lutz, 2000).

1.2.2 Classification of *Zingiber officinale*

The previously accepted classification of the *Zingiberaceae* which primarily distinguished based on morphological features both vegetative and floral have divided the family into four tribes namely; *Alpinieae, Globbae, hedychieae* and *zingibereae* (Larsen *et al.,* 1999). onsequently, a new classification of *Zingiberaceae* based on the Dioxonuclic acid (DNA) data have recognised four subfamilies and six tribes have been recognised namely; *Sihanoechiloide* (tribe *si honochileae), Alpinioideaec* (tribe *Alpiniea* and tribe *riedelieae)* and *Zingiberoideae* (tribe *Zingibereae and Globbeae)* (Kress *et al.* 2002). The genus *Zingiber* is considered as a strongly monophyletic group by (Kress *et al.,* 2002) and (Thecrakulpisut et al. 2012) that performed phylogenetic analyses of the Zingiber based on its data. Jatoi *et al.* (2008) investigated the genetic variability of *Zingiber Officinale* from ex-situ gene bank, farm and rural markets and the genetic relationships of three *Zingiber* species, Viz., *Z officinale, Z barbatum* and *Z moiga* using SSR markers. Wahyumi *et al.* (2003) found relatively diverse accessions of big, small and red ginger cultivars in Indonesia based on amplified fragment length polymorphism (AFLP) analysis of their respective DNA.

1.2.3 Cultivation and Harvest *of Zingiber officinale*

Today *Zingiber officinale* is cultivated worldwide throughout the subtropics and tropics where it plays an important role in agricultural economic systems in these regions (Kavitha and Thomas, 2008). The usable part of the plant is underground stem or rhizome which can consumed fresh or for culinary purposes or as a paste or extracted as ginger oil or oleoresin (Kizhakkayil and Sasikumar, 2011).

Zingiber species exhibit both sexual and asexual reproduction and therefore offer the potential of introducing variability to the cultivated crop including potential resistance traits (Kavitha and Thomas, 2008).

On the average, *Zin giber Officinale* takes about nine months from the time of planting to mature (Brian, 2014). The rhizome can be harvested at different times depending on its purpose. If fresh is required, it is harvested about six months after planting. If a mature ginger rhizome is required, it is harvested nine months after planting. Sometimes the rhizomes are left in the ground for nearly two years for propagation to continue. In Nigeria, harvesting begins in October to May and the rhizome can be harvested manually by hand or with machines such as the mechanical digger (Brian, 2014).

Lisa (2016) also reported that *Zingiber offIcinale* can be harvested at four months but just a little piece of rhizome at a time. Some rhizome can be save back to be replanted next year as long as they are kept at 55 degree or higher, they should still be valuable next year.

1.3 Uses *of Zingiber officinale*

Zingiber officinale (ginger) is one of the world's more well- known and useful plants being used for centuries as a spice for flavouring food and as a medicinal plant. Gingeale is an example of a currently popular beverage that includes ginger and also utilizes ginger's reputation as a digestive aid, a property that was utilized even in ancient Greece (Crawford and Odle, 2015). Various uses of ginger are discussed as follows.

1.3.1 Medicinal uses

Crawford and Odle (2005) reported that ginger was historically used to aid digestion, with even ancient Greeks eating it wrapped in bread as an after dinner digestive. This lead to the creation of ginger bread, later, the English developed ginger beer as a means to smooth the stomach. (Crawford and Odle, 2005).

Zingiber officinale (ginger) compounds are active against a fomi of diarrhoea, which is a leading cause of infant death in developing countries. Research on rats suggests that ginger may be useful for treating diabetes (Al- Amin *et al* 2006; Afshari *et al* 2000). Zingerone is likely to be the active constituent against entrotexin — induced diarrhoea (Chan *et al,* 2007). *Zingiber officinale* (Ginger) has been found effective by multiple studies for treating nausea caused by seasickness, morning sickness and chemotherapy (Ernest and Pittler, 2000). There are a variety of other uses suggested for *Zingiber Officinale* (ginger). Tea brewed from ginger is a folk remedy for colds and ginger water was commonly used to avoid heat cramps in the United State. In china, a drink made with sliced ginger cooked in sweetened water or a cola is used as a folk medicine for common cold (Jakes, 2007).

1.3.2 Nutritional or food uses

As a spice for culinary purpose, ginger root may be used fresh (grated, ground or silvered) or dried and ground (Herbst, 2001). Powdered dried ginger root (ginger powder) is typically used to add spices to gingerbread and other recipes. Ground and fresh ginger taste quite different and ground ginger is poor substitute for fresh ginger. Fresh unpeeled ginger can be refrigerated up to three weeks if tightly wrapped and up to six month if frozen (Herbst, 2001).

Zingiber officinale (ginger) is composed of about *50%* starch, 9% protein, 6-9% lipids a little over 2% protease, 1-3% volatile oils as well as vitamin A and niacin (Crawford and Odle, 2005). The pungent taste of *Zingiber Officinale* is due to non volatile phenyl propanoidderived compounds, particularly gingerols and shogaols. The latter are from the former when ginger is dried or cooked. Zingerone is also produced from gingerols during this process and it is less pungent and has a spicy-sweet aroma (McGee. 2004).

1.3.3 Industrial uses

Zingiber Officinale showed a unique and characteristic organoleptic and chemical profile which makes them ideal for cosmetic application. Because of its properties this channel has selected ginger and its extractives for use as ingredients for their line of perfumes (Fabien *et a!.* 2009). In Malaysia, extracts from the rhizome of ginger have been commercially used for skin lighting products (Ujang *et al.* 2005, Abdul Rahman *et al. 2005).*

1.4 Preservation and Storage *of Zingiber officinale*

Zingiber Officinale basically involves two stages of drying; peeling the rhizomes to remove the outer skin and sun or mechanical drying to a safe moisture level (Balakrishnan, 2005). For converting to dry ginger, the crop is harvested at full maturity. In most growing areas, the scraped ginger is dried in the sun. But where unfavourable seasonal conditions prevails, improved drying methods using mechanical or solar dryers, *57.2* degrees is reported to be the highest temperature at which ginger for the spice market could be dehydrated (Ravindran and Nirmal, *2005).* Above the temperature, the colour trend to become darker (Laha *et al.* 2012). In the experiment: used a batch type cabinet dryer in drying ginger rhizome, the dryer was designed and manufactured in 'thermal engineering division' of CSIR-Central Engineering Research Institute Durgapur, India. (Laha *et al.*2012).

Dried rhizomes, slices or splits should be stored in a cool environment (10 - 15 C). When stored at room temperature (23-26 C), losses of up to 20 C oleoresin (dry weight) were observed on dry ginger after 3 months and the content of (6)-gingerol decreased (Onyenekwe, 2000).

1.5 Review of Related Works Done by Various Authors

Watal *et al.* (2004) preliminarily screened phytochemicals of six medicinal plants used in traditional medicine. Watal and his co authors collected leaves of the plants, washed, shade dried and powered. They were then extracted with hot distilled water using soxhiet apparatus till a colourless solvent was obtained. Extract obtained were filtered, concentrated and allowed to dry till constant weight was obtained. Screening of these medicinal plants for various phytochemicals constituent were carried out using standard methods.

At the end of the study, screening of six selected medicinal plants clearly reveals that the maximum classes of pytochemicals are present in S. *Chirata* extracts as compared to other five selected extracts. Hence the above plant extracts could be explored for its highest therapeutic efficiency by pharmaceutical companies in order to develop safe drugs for various ailments.

Latona *et al.* (2012) also carried out phytochemical screening on ginger root; they collected fresh ginger root without any physical effect. They were surface cleaned and washed to remove adhering debris after which

the samples were air dried for five days in air dryer and ground to fine powder using the commercial blender. The powdered samples were stored at *5* degrees until further analysis. Samples were analysed chemically according to the methods of (AOAC). Analyses were carried out using powdered ginger root and were done in duplicate to determine crude protein, ether extract, crude fibre, ash content and moisture content.

At the end of their study, it was revealed that the ginger root contained high amount of fibre content, fat/ oil, protein and essential minerals coupled with the therapeutic value of ginger root. Ginger root have a wide application in the area of food bio-fortification and for the development of bio-fortified food. Although ginger roots have been used several years as medicinal herbs for treatment of cancer cells and several other therapeutic purposes, it has however found to be without any side effect. Majorly ginger may interfere with blood clothing.

In phytochemical and Antioxidant Analyses of selected edible Mushrooms, Ginger and Garlic from Ebonyi State, Nigeria by Ude *et* al. (2014), samples were collected, washed, sun dried for 6 days and then pulverized into powder using manual grinder. Samples were weighed and soaked in cold water, hot water and ethanol respectively. Cold water was allowed to stand for 2 days with intermittent shaking at 30 minutes interval. Hot water was allowed to stand for 24 hours. The ethanol and diethyl ether was allowed to stand for 7 days. Then the four preparations were filtered using Whatman filter paper No. 1. The filtrate was poured in crucible and air dried at room temperature.

The following phytochemicals were determined in the mushrooms, ginger and garlic extracts; phytic acid, tannin, alkaloids, saponin, flavonoid phenolies proanthocyanains and cyanogenic glycoside. Using the method adopted by Fasidi and Jonathan (2000). And at the end of their study, the presence of the phytochemicals in the tested material could possibly account for medicinal and health benefits of these plants. Also observed is the fact that mushroom and ginger could be better antioxidants than garlic because of their high phenolies and flavonoid contents. It was therefore recommended that these plants should properly be harnessed in the management and treatment of oxidative stress induced conditions, bacterial and viral diseases, cancer, diabetes, allergy, platelet aggregation, arthritis, asthma and used as blood cleansers and warm expellant.

Nwinuka *et al*. (2005) carried out proximate analysis and level of some toxicants in four commonly consumed spices; ginger, garlic, Ashanti pepper and onions. Samples were collected, dirt were removed and washed. All prepared samples were dried in an air-circulating oven in the laboratory and were ground manually into powder using the manual blender. Samples sieve and stored in an air refrigerator until required for analyses. The proximate composition of the samples was determined using the methods of AOAC (1990) to determine moisture content, ash content, crude protein, crude lipid and total carbohydrate content.

At the end of their study, proximate composition of these spices revealed them to be poor sources of proteins, fats and ash, but good sources of carbohydrate. The crude fat protein of Ashanti pepper was not high enough to be called an oil seed. These explanations and finding agree with the definition of spices as mere food adjuncts used to give piquancy to tasteless food dished up in the home, cafes and restaurants. Thus, they serve mainly to add flavour, aroma and taste to food and dishes.

Olubunmi *et al.* (2013) carried out, proximate mineral antinutrient, acid and phytochemical components of two varieties of ginger *(Zingiber officinale).* Samples were collected, washed, thinly sliced, oven dried at 60Cc for 72 hours and milled. The powder obtained was stored in airtight plastic containers under refrigeration until needed for use.

The proximate, mineral, antinutrient, amino acid and phytochemical components of the samples was determined using the methods of AOAC (2002) to determine protein, fat, ash, moisture, fibre, sodium, calcium, magnesium, zinc, copper, saponins, tannis, cyanide, phytic acid and glycosides and carbohydrate.

At the end of their study, the proximate compositions of two varieties of ginger *(Zingiber offlcinaie)* white and yellow have low moisture content. The two varieties contained appreciable amount of carbohydrate rich spices. The mineral analysis of the two varieties of ginger indicated their richness in calcium, magnesium, zinc and copper. The phytochemical analysis indicated that the two ginger varieties are rich in phytonutrients which revealed the presence of saponin and glycosides. The results of antinutritional factors of two varieties of ginger may be for the defense of the stored resources of food for the use of the plant and level at which they occur in the two ginger varieties are safe for consumption by man and animals. With the above results there are indications that the two varieties are good sources of nutrients, mineral element and phytochemicals. Therefore, their use as nutritional supplements is highly promising.

Nuhu *et al*. (2004) carried out proximate analysis of ginger, scotch bonnet pepper, garlic, bell pepper and onion samples. Samples were collected, washed before being chopped into tiny pieces and were dried at room temperature for 3 weeks and later dried in an air circulating oven in the laboratory to complete dryness. The samples were ground manually to powdered form, there were sieved and ready for analysis and stored in an air tight cellophane bag as stock sample and kept until required for analysis.

The proximate composition of each samples was determined using the methods of Association of Official Analytical Chemists, AOAC (2006) to determine moisture content, ash content, crude lipid carbohydrate content.

At the end of the study the proximate composition of ginger, scotch bonnet pepper, garlic, bell pepper and

onion samples showed that all samples have significantly different nutritional compositions. This difference may probably reflect the difference in the origin and varieties of the samples. The highest values of all the parameter was carbohydrate content which ranged from 61% in bell pepper to 76% in ginger. Although the results showed that these samples accumulate sugar in them but cannot be considered as carbohydrate sources as compared to tubers and cereals which are spread throughout the world (Jayakody et *al.* 2005). The samples were found to be relatively good dietary component of carbohydrate, lipids and protein. The crude lipid concentration in bell pepper was not enough to be called oil seed. This may be why these samples are used as mere spices and not as major sources of food nutrients. These findings agree with the fact that spices are mere food adjuncts used to give piquancy to tasteless food dished up in homes, cafes and restaurants. Thus, they serve mainly to add flavour, aroma and taste to food dishes.

2.0 Materials and Methods

2.1 Apparatus/Materials and Instruments

Apparatus and materials used include; weighing balance, beakers, crucible, filter paper, litmus paper, test tubes, test tube holder, volumetric flask, desiccators, distillation apparatus, spatula, measuring cylinder, thermometer, mortar and pestle, funnel, conical flask, Buchner funnel and a sieve. However, the instruments used are hot air oven, muffle furnace, water bath, heating mantle and pH meter.

2.2 Reagents

Ethanol, diethyl ether, petroleum ether, hydrochloric acid, sodium hydroxide, potassium hydroxide, acetic acid, sodium sulphate, copper sulphate, Fehling solution A and B, Benedict's solution, sulphuric acid, faric chloride, ferric sulphate, ammonia, acetone, Mayer's and Wagner's reagents, a-naphthol in ethanol, anhydrous sodium sulphate, boric acid, screened methyl red indicator and selenium dioxide.

2.3 Collection of Materials

About 50g of *Zingiber officinale* was purchased randomly from five vendors in Keffi market of Keffi Local Government of Nasarawa State on 28 May, 2021 at about 8: 30am to 10: 12am into labeled polythene bags and transported to the analytical chemistry laboratory for analyses.

2.4 Laboratory Methodology

Various analyses were carried on the samples as follows.

2.4.1 Sample Preparation

Unwanted materials like insects, pebbles, grass leaves etc. were removed from the samples to ensure true representation of them. They were thereafter sliced and air dried for seven days (Ibitoye, 2005).

2.4.2 Grinding (surface area reduction) of samples

This is done according to the method reported by Daniyan and Mohammed (2008). Samples were ground into powder manually using mortar and pestle and a sieve.

2.4.3 Extraction of phytochemicals from samples by maceration

This is done according to the method reported by Daniyan and Mohammed (2008). 50g each of the Samples were soaked with 300 cm^3 of distilled water, ethanol and diethyl ether respectively for 24 hours at room temperature with occasional shaking, the mixture was filtered and the filtrates were phytochemically screened. pH of samples filtrates were measured.

2.4.4 Phytochemical Screening

Phytochemicals present in the samples were qualitatively identified using the method reported by Lawel *et al.* (2010) as follows.

2.4.4a. Test for alkaloids

About 3 cm^3 of each sample extract was measured into a test tube; l cm^3 of 10% HCl was added to it and was heated for 20 minutes on a steam bath at 80 – 90 °C. The mixture was allowed to cool and filtered. l cm^3 of the filtrate was treated with 3 drops of Mayer's and Wagner's reagents until a creamy and reddish color appeared.

2.4.4b. Test for saponins

About 5 cm^3 of sample's filtrate was measured into a test tube and strongly shaken until a formation of large amount of froths that lasted for 30 minutes was confirmed.

2.4.4c. Test for flavonoids

About 1 cm^3 of 1.5M NaOH was mixed with 3 cm^3 of sample's filtrate in a test tube until a yellowish solution appeared.

2.4.4d. Test for tannis

5 drops of freshly prepared 10 % KOH was added to 1 cm^3 of sample's filtrate until a dirty white precipitate appeared.

2.4.4e. Test for cardiac glycosides

About 2 cm^3 of acetic acid, 2 cm^3 of 1% ferric sulphate and 2 drops of concentrated H_2SO_4 were respectively added to 2 cm^3 of sample's filtrate in a test tube until a blue layer appears due the presence deoxy sugar.

2.4.4f. Test for phlobatanins

About 2 cm^3 of sample's filtrate was added to 2 cm^3 of 1 % aqueous HCl in a test tube and the mixture was boiled until a deposit of red precipitate was confirmed.

2.4.4g. Test for anthraquinones

About 5 $cm^3$of 10 % ammonia was added to 5 $cm^3$of the extracted sample in a test tube, the mixture was shaken until the presence of pink, red or violet color appeared.

2.4.4h. Test for carbohydrates

Molisch's test was conducted on the sample: 2 $cm^3$of sample's filtrate was added to l0 $cm^3$of distilled water and 2 drops of 20 % a-naphthol in ethanol with 2 cm^3 of concentrated H_2SO_4 in a test tube until a reddish violet colored ring appeared at the inter-phase.

2.4.4i. Test for reducing sugars

Fehling test was conducted on the samples. 5 cm^3 of an equal mixture of Fehling solution A and B was added to 2 cm^3 of the sample in a test tube and was boiled on a water bath until a brick red precipitate appeared.

2.4.4j. Test for combined reducing sugars

2 cm^3 of sample was added to 2 cm^3 of Benedict's solution in a test tube and was swirled. It was then boiled in a water bath for 5 minutes until a blue color appeared.

2.5 Proximate Analysis of Samples

The following analyses were carried out on the samples according to the methods reported by Association of Official Analytical Chemists, AOAC (2006).

2.5.1 Determination of moisture content

Oven dry method was used to determine moisture content of the samples. 1.0 g of the air dried samples was weighed in triplicate and placed in a washed, dried and weighed crucible. This was placed in an oven and dried at 105 °C for 30 minutes. They were removed, allowed to cool in desiccators and weighed. The crucibles with their contents were again transferred back to the oven, heated, removed after 30 minutes, allowed to cool and weighed – this was repetitively done until constant or stable values for mass of crucibles with contents after cooling were obtained. The percentage moisture content was calculated using the formula

% Moisture content

2.5.2 Determination of ash content

The ash content was determined using the ignition method. The crucible used were thoroughly washed and pre-heated in a muffle furnace at 500 °C. 1.0 g of the oven dried sample used in moisture determination were weighed in triplicate and placed in the pre-heated cooled and weighed crucible and then reweighed. The crucible was covered with its lid, the number noted and then placed in a cold muffle furnace. The temperature was allowed to rise to 500 °C and the ashing carried out for three hours after which the crucibles were removed from the furnace, allowed to cool in desiccators and reweighed. The percentage ash content was calculated using the formula

% Ash content ×100

2.5.3 Determination of crude protein

This was done by determining the total organic nitrogen first using the macro-kjeldhal method. This involved digestion, distillation and titration. 1.0 g of the sample was weighed in triplicates and placed in digestion flasks. Few granules of anti-bumps and about 3.0 g of copper catalyst mixture (96 % anhydrous sodium sulphate) 3.5 % copper sulphate and 0.5 % selenium dioxide were added to each of the flasks. Digestion was then commenced by adding to each flask 20 cm^3 concentrated sulphuric acid and heated on a heating mantle. Digestion was continued until a clear solution was obtained and then the flask was allowed to cool. The digest was then filtered and made up to l00 cm^3 with distilled water. 20 cm^3 of the diluted digest was pipette into a round bottomed flasks and used in the distillation step.

Distillation

A round-bottomed flask was set on a heating mantle and connected using a Liebig condenser to a beaker (receiver flask) containing 20 cm^3 of 2 % boric acid with screened methyl red indicator. The condenser was submerged in the boric acid by the use of a Buchner funnel. Exactly 30 cm^3 of 4 0% sodium hydroxide was then injected into the flask and distillation of the ammonia formed commenced by heating the flask. The distillation was continued until the boric acid solution completely changed from purple to greenish-yellow. The boric acid mixture (containing the ammonium borate complex formed) was then titrated with 0.1 M to colorless end point and the titter value was noted. The total organic nitrogen was then calculated using the formula:

%

Where,

TV = Titer value
NE = mg nitrogen equivalent to molarity of acid
TVd = Total volume to which digest was diluted
Ms = Mass of sample (g)
Vd = volume of digest distilled

Then,

% Crude protein (a factor)

2.5.4 Determination of crude fibre

About 2 g of the sample (W_1) was accurately weighed into conical flask and l00 cm^3 of 0.225 N H_2SO_4 was added. The mixture was heated under reflux with the heating mantle. The hot mixture was filtered through a fibre sieve cloth. The difference obtained was thrown off and the residue was returned to the flask to which l00 cm^3 of 0.313N of sodium hydroxide (NaOH) was added and heated under reflux for another 1 hour. The mixture was filtered through a fibre sieve cloth and 10 cm^3 of acetone was added to dissolve any organic constituent. The residue was washed twice with 50 cm^3 hot water on the sieve cloth before it was finally transferred into the crucible and was oven dried at 105 °C overnight to drive off moisture. The oven dried crucible containing the residue was cooled in desiccators. The crucible containing white and gray ash (free of carbonaceous material) was cooled in desiccators and weighed to obtain W_2. The difference W_1 — W_2 give the weight of fibre.

%

2.5.5 Determination of crude lipid

Determination of crude lipid content of the samples was done using Soxhlet type of the direct solvent extraction method. The solvent used was petroleum ether (boiling range 40— 60 °C). 3.0 g of the dried sample was weighed in triplicate and secured in Soxhlet extraction thimble. The thimble was then put into 20 cm^3 capacity Soxhiet extractor. A washed oven dried l00 cm^3 round bottomed flask was weighed and approximately 60 cm^3 of the 40 — 60°C boiling range petroleum - ether was added to it. The flask was then mounted on the heating mantle and connected to the extractor (with condenser). The condenser and heating mantle were then activated and extraction carried on for four hours. At the end of the extraction, the solvent was evaporated and the flask dried in the oven at (60°). The flask was then cooled and reweighed. The percentage crude lipid was calculated using the formula;

%

Where,

Mex = Mass of extract (lipid) (g)
Ms = Mass of sample used (g)

2.5.6 Determination of nitrogen free extracts (Digestible carbohydrate)

Each sample was estimated by the difference in the equation below. In this, the sum of the percentages of all the other proximate components was subtracted from 100 that is,

NFE (%) = 100 - (% moisture + % crude protein + ash content + % crude fibre + % crude lipid)

3.0 Results

Tables 1 and 2 show the result of Phytochemicals screening of ethanolic, petroleum ether, distilled water extracts and results for proximate analysis of the *Zingiber officinale* (ginger) respectively.

Table1: Phytochemical Profile of Ethanol, Petroleum ether and Distilled Water Extracts of *Zingiber officinale*

Phytochemicals	Ethanol extract	Petroleum ether extract	Aqueous extract
Alkaloid	+	+	+
Saponin	-	+	-
Flavonoids	+++	++	-
Tannins	+	+	+
Cardiac glycosides	+	+	-
Phlobatannins	+	+	+
Anthraquinones	+++	+	+
Carbohydrates	+	+	+
Reducing sugars	+	+	+
Combined reducing sugars	+	+	+

Table notes:

(+++) = highly present
(++) = moderately present
(+) = present
(-) = absent

Table 2: Proximate Composition of the *Zingiber officinale*

Parameters	Amount (%)
Moisture content	46.9
Ash content	13.6
Crude fibre	75
Crude lipid	3.5
Crude protein	13.7
Digestible carbohydrate	12.8

4.0 Discussion

The following symbols represents the level of phytochemicals detected from the samples; + (present), and ++ (moderately present), +++ (highly present). The qualitative analysis shows different phytochemicals at various detection levels. From the results; alkaloids was present in all the extracts, saponins was absent in ethanolic extract, present in petroleum ether extract and absent in aqueous extract, flavonoids was present at higher level in ethabolic extract, moderately present in petroleum ether extract but absent in aqueous extract, tannins was present in all extracts, cardiac glycoside was present in both ethanolic and petroleum extracts but absent in aqueous extract, Phlobatannins was present in all extracts, anthraquinones was highly present in ethanolic extract but present in both petroleum ether and aqueous extracts however, carbohydrates, reducing sugars and combined reducing sugars were present in all extracts.

Flavoniod is known to exhibit strong antioxidant activities which include protection of the body against free radicals (Ghasemzadeh *et al.* 2010). The test plant also shows the presences of tannins which have been reported to have high medicinal value (Sexena *et al.* 2013). Tannins are also useful in the textile industry as dyes and also as coagulants for clarification of beer in the food industry (Ezekwesili *et al.* 2004). This sampled material is considered rich in phytochemicals and this perhaps explains their wide applications in traditional medications.

The results of the proximate composition ginger showed that all samples have significantly different nutritional compositions. This shows that the moisture contents of the samples was 46.98 % showing that ashing of fresh ginger could be time consuming. The ash content was 13.64 % which indicates the levels of essential or non-essential mineral elements in the samples. The crude proteins were determined to be 13.7 % which is higher than the 12.6 % reported by Bhat *et al.* (2010). The high amount indicates the good source of protein. The crude lipid contents were 3.5 % and thereby moderate because samples low in fat is advantageous as they may reduce the risk of coronary heart disease and lower the risk of hypertension, the crude fibre content was 75 % which is of course higher than the 17.6 % reported by Bhat *et al.* (2010). And digestible carbohydrates content was 12.8 %.

4.1 Conclusion

The results of the phytochemical screening shows that alkaloids, tannins, cardiac glycosides, anthraquinones, fiavonoids, phlobatannins, carbohydrates, reducing sugars and combined reducing sugars were present. Similarly, proximate analysis results obtained in percentage in the ginger was average moisture content:(46.9 %), ash content:(13.6 %), protein content:(13.7 %), carbohydrate contents(9.2 %), fat content:(3.5 %) and fiber content: (75 %) values of the rhizomes. The results indicated that ginger rhizome is an excellent natural remedy for a wide range of ailments.

4.2 Recommendations

It is recommended that ginger should be properly harnessed in the management and treatment of oxidative induced conditions, diabetes and used as blood cleanser.

Quantitative analyses of these phytochemicals will be an interesting area for further study. Effort should be geared up to exploit the biomedical applications of these screened plants due to the presences of certain class of phytochemicals for their full utilization. It is therefore recommended that the government should promote the growth and harvest of ginger by providing loan for ginger farmers to enable them cultivate this plant in large quantity.

References

Al-Amin, Z.M., et al. (2006) Anti-Diabetic and Hypolipidaemic Properties of Ginger (Zingiber officinale) in Streptozotocin-Induced Diabetic Rats. British Journal of Nutrition, 96, 660-666. https://doi.org/10.1079/BJN20061849

Altman R. D., Marcussen K. C. (2001) Effects of a ginger extract on knee pain in patients with osteoarthritis National Library of Medicine 8600 Rockville Pike Bethesda, MD 20894

Balakrishnan K. V. (2005) Postharvest and industrial processing of ginger. In: Ravindran, P N, and Babu K. Nirmal. Ginger: The Genus Zingiber. Boca Raton, Fla: CRC Press, 2005. Print.

Chan, C.M., Ma, C.W., Chan, W.Y., Chan, H.Y.E. (2007). The SARS-Coronavirus Membrane protein induces apoptosis through modulating the Akt survival pathway. Arch. Biochem. Biophys. 459(2): 197--207.

Crawford, S., Odle T. G. (2005). Thyme. In J. L. Longe, ed., The Gale Encyclopedia of Alternative Medicine. Farmington Hills, Mich: Thomson/Gale. ISBN 0787693960.

Ernst, E. M. H. Pittler. (2000). Efficacy of ginger for nausea and vomiting: a systematic review of randomized clinical trials. British Journal of Anesthesia 84(3): 367–371. Retrieved April 8, 2008.

Grant K. L. and Lutz R. B., (2000) "Alternative Therapies: Ginger," American Journal of Health-System Pharmacy, Vol. 57, No. 10, 2000, pp. 945-947.

Ibitoye, A. A. (2005). Laboratory manual on basic methods in plant analysis. Concept +IT and Educational Consults, Akure, Nigeria.

Jatoi A., Rowland K., Sloan J.A., Gross H.M., Fishkin P.A., Kahanic S.P., (2008) Tetracycline to prevent epidermal growth factor receptor inhibitor-induced skin rashes: results of a placebo-controlled trial from the North Central Cancer Treatment Group (N03CB). Cancer 2008 Aug 15;113(4):847-53 Available from: http://www.ncbi.nlm.nih.gov/pubmed/18543329.

Jakes, S. (2007). Beverage of champions. Times on-line January 15, 2007. Retrieved April 8, 2008.

Kavitha P. G., Thomas G. (2008) Population genetic structure of the clonal plant Zingiber zerumbet (L.) Smith (Zingiberaceae), a wild relative of cultivated ginger, and its response to Pythium aphanidermatum

Kizhakkayil J., Sasikumar B., (2011) Diversity, characterization and utilization of ginger: a review Published online by Cambridge University Press: 01 June 2011

Larsen T. M., Boehlein S. K., Schuster S. M., Richards N.G., Thoden J. B., Holden H. M., Rayment I. (1999) Three-dimensional structure of Escherichia coli asparagine synthetase B: a short journey from substrate to product. *Biochemistry* 38(49):16146-57

Lawal A. R., Olayinka B.U., Murtadha R.A., Ayinla A., Etejere E.O., Comparative Analysis of Phytochemical and Proximate Composition of Allium sativum L. and Zingiber officinale Rosc. Nigerian Journal of Basic and Applied Science (December, 2018), 26(2): 82-87 ISSN 0794-5698

Liu R. H. (2003) Health benefits of fruit and vegetables are from additive and synergistic combinations of Phytochemicals The American Journal of Clinical Nutrition, Volume 78, Issue 3, September 2003, Pages 517S–520S, https://doi.org/10.1093/ajcn/78.3.517S

McGee, H. 2004. On Food and Cooking: The Science and Lore of the Kitchen, 2nd ed. New York: Scribner. ISBN 0684800012.

Nwinuka, N.M., Ibeh, G.O. and Ekeke, G.I. (2005).Proximate composition and levels of some toxicantsin four commonly consumed spices. Journal of Applied Sciences and Environmental Management, 9(1): 150-155.

Okwu, D.E. (2004) Phytochemical and Vitamin Content of Indigenous Species of South-Eastern Nigeria. Journal of Sustainable Agriculture and the Environment, 6, 30-37.

Ohn kress W. J., Linda M. Prince, Kyle J. Williams (2002) The Phylogeny and a New Classification of The Gingers (Zingiberaceae): Evidence From Molecular Data, American Journal of Botany 89(11): 1682–1696.2002.

Onyenekwe P. C. (2000) Assessment of oleresion and gingerol content in gamma-irradiated ginger rhizomes. Nahrung 44(2), 130-132

Olubunmi B. A., Seun F. A., and Funmilayo T. A. (2013) Hindawi Publishing Corporation ISRN Nutrition Volume 2013, Article ID 359727, 5 pages http://dx.doi.org/10.5402/2013/359727

Ravindran P. N., Babu N. K. (2005) Ginger The Genus Zingiber Copyright Year 2005 ISBN 9780415324687 Published December 28, 2004 by CRC Press 576 Pages 153 B/W Illustrations

Randall, R. P., (2012). A global compendium of weeds. Dpt. Agric. Food Western Australia, 1124 pp. Web

Sutarno H, Hadad EA, Brink M, (1999). Zingiber officinale Roscoe Record from Proseabase. In: Guzman CC de, Siemonsma JS, Eds. Bogor, Indonesia: PROSEA (Plant Resources of South-East Asia) Foundation. http://www.proseanet.org.

Thomson M., Al-Qattan K. K., Al-Sawan S. M., Alnaqeeb M. A., Khan I., Ali M. The use of ginger (Zingiber officinale Rosc.) as a potential anti-inflammatory and antithrombotic agent, National Library of Medicine 8600 Rockville Pike Bethesda, MD 20894

Wahyuni S., Xu D. H., Bermawie N., Tsunematsu H., Ban T. (2003). Genetic relationships among ginger accessions based on AFLP marker. J Bioteknologi Pertanian 8:60–68

Herbst, S. T. 2001. The New Food Lover's Companion: Comprehensive Definitions of Nearly 6,000 Food, Drink, and Culinary Terms. Barron's Cooking Guide. Hauppauge, NY: Barron's Educational Series. ISBN 0764112589.