PROXIMATE ANALYSIS AND PHYTOCHEMICAL EVALUATION OF SOME COMMONLY USED FOOD SPICES IN SOUTH-EAST NIGERIA

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ABSTRACT
Spices and herbs are potent sources of natural antioxidants. The proximate composition and phytochemical constituents of some commonly used food spices in South-East Nigeria were analyzed. The result showed that *Tetrapleura tetraptera* has the highest percentage per weight ash followed by *Xylopia aethopica, Monodora myristica, Syzygium aromaticum, Chrysobal anusicaco* and *Afromo mumdanielli* (9.42, 6.97,6.49,5.94, 5.89 and 3.35%) respectively. The percentage crude protein contents are 7.80, 13.89, 21.67, 11.65, 6.78 and 10.94 respectively. The percentage crude fibre contents are 18.56, 9.28,7.38, 9.06, 11.24 and 13.00 respectively. The percentage carbohydrate contents are 54.66, 52.94, 41.02, 54.26, 61.36 and 53.48 respectively, while fat moisture contents are 4.45, 7.81, 13.24, 9.21, 4.79, 7.16 and 5.11, 9.59, 9.72, 9.88, 9.94, 11.63 respectively. The phytochemical analysis revealed the presence of Flavonoids, anthraquinones, saponin, phenol, tannin, alkaloids, cardiac glycosides and terpennoids in all the tested spices, with the exception of anthraquinone which was not detected in *Afromo mumdanielli*. This is an indication that spices add nutritional and ethno-medicinal values to the diet.

INTRODUCTION

Medicinal plants are important elements of traditional medicine in virtually all cultures. The idea that certain plants had healing potential was known long before human beings discovered the existence of pathogens. The therapeutic efficacies of many indigenous plants for various diseases have been described by traditional herbal medicine practitioners. Biologically active compounds present in medicinal plants have been of great interest to scientists working in the field. Phytochemical studies have attracted the attention of plant scientists due to the development of new and sophisticated techniques. These techniques played a significant role in giving the solution to systematic problems on the one hand and in the search for additional resources of raw materials for pharmaceutical industry on the other hand. Plant synthesizes a wide variety of chemical compounds, which can be sorted by their chemical class, biosynthetic origin and functional groups into primary and secondary metabolites (Mukherjee and Laloraya, 1977). Primary metabolites make up the physical integrity of the plant cell and are involved with the primary metabolic process of building and maintaining of living cells. Secondary metabolites do not seem to be vital to the immediate survival of the organism that produces them and are not an essential part of the process of building and maintaining living cells, but are responsible for their therapeutic potentialities (Sharanabasappa *et al, 2007*). Many of the indigenous medicinal plants are used as spices and food plants.

A spice is a dried seed, fruit, root, bark or vegetative substance primarily used for flavouring, colouring or preserving food. Sometimes, a spice is used tohide other flavours(Scully, 1995). The cravings for spices have been one of the great factors in human progress and have done much to change the course of history and geography and to promote international relations (Akindahunsi and Salawu, 2005). Spices are used to season insipid foods and to add zest to an otherwise monotonous diet. They stimulate the appetite and increase the flow of gastric juice. For this reason they are often referred to as food accessories or adjuncts. They also play a role in manyother industries, and are used in perfumery, soaps, incense, as dyes in histology and in various acts (Onyesom and Okoh, 2006).

Studies on spices have been mostly on their exciting flavors and aromas, medicinal values and as flavorings agents. These spices are said to be therapeutically useful in the management of several ailments which include convulsion, leprosy, stomachache, inflammation, rheumatoid pains, cough, loss of appetite, gastro-intestinal disorder (Okwu, 2004; Valko et al., 2007). The spices are used for preparing soups for mothers

from the first day of delivery to prevent postpartum contraction and aid lactation (Okwu,1999; 2001). They are also used for spicing meat and other foods. Most of these spices have been associated with abundant bitter principle which is claimed to reduce blood sugar levels, and their liquor taken as a purge for colic, stomach pains, and worm infections. It is also believed that newborn babies grow rapidly when they are fed with food made of these spices (Roger, 2002). The spices grow commonly in high forest areas of the South Eastern region of Nigeria, as climbers, perennial creepers, or slim shrubs and trees and are available all year round (Sofowora, 1993). Proximate and nutrient analysis of medicinal plants, edible fruits and vegetables plays a crucial role in assessing their nutritional significance (Pandey *et al*., 2006). As various medicinal plant species are also consumed as food along with their medicinal benefits, evaluating their nutritional significance can help to understand the worth of these plant species (Pandey *et al*., 2006). There are also various claims about the usefulness of these spices, especially their use in fattening homes, and remarkable growth of new born babies whose mothers use these spices. In addition, the World Health Organization supports the use oftraditional medicine provided they are proven to be efficacious and safe (WHO 1985). In some developing countries, a huge number of people still live in extreme poverty and some are suffering and dying for want of safe water and medicine, they have no alternative for primary health care. There is therefore the need to look inwards to search for medicinal plants with the aim of validating the ethno-medicinal use and subsequently the isolation and characterization of compounds which will be added to the potential list of drugs. This study therefore focuses on the phytochemical and proximate composition of these spices. The results of this study will aid in appreciating the acclaimed medicinal properties of these spices and their age long usage by the people of South East of Nigeria. The spices analyzed were *Syzygium aromaticum, Chrysobalanus Icaco, Afromomum danielli, Xylopia aethopica, Monodora myristica* and *Tetrapleura tetraptera*. These spices have been described variously by Smith *et al.*, 1996.

MATERIALS AND METHODS

Processing of samples

The spices were bought as sold from Oyingbo market Lagos state of Nigeria, and identified taxonomically at the Department of Botany, Olabisi OnabanjoUniversity Ago Iwoye, Ogun State. The samples were washed with distilled water and dried in the oven at 65°C. The dried sampleswere milled in an Arthur Thomas coated milling machine andscreened through 1 mm sieve to obtain a fine powder of processed sample. These were kept in separate air tight containers for later use.

Proximate analysis

The proximate analysis (carbohydrate, fats, protein, moisture, fibre and ash) of spices sample was determined by using AOAC (1995) methods. Carbohydrate was determined by difference method (100 – (protein + fat + moisture +fibre + ash)). The nitrogen value, which is the precursor for protein of a substance, was determined by micro– Kjeldahl method (Guebel et al., 1991). The nitrogen value was converted to protein by multiplying with a factor of 6.25. The moisture and ash were determined using weight difference method while determination of crude lipid content of the spices sample was done using Soxhlet type of the direct solvent extraction method while crude fibre was determined using acid/base method. The solvent used was petroleum ether (boiling range 40 to 60°C). All the proximate values were reported in percentage (AOCS, 2000; Okwuand Morah, 2004).

Phytochemical screening

Phytochemical screening procedures carried out were adapted from the previous work on plant analysis (Sofowora, 1993; Trease and Evans, 1996; Harbourne, 1998). This analysis determines the biologically active nonnutritive compounds that contribute to the flavor, colour and other characteristics of plant parts. They are flavonoid, anthraquinone, saponin, phenol, tannin, alkaloid, cardiac glycoside and terpennoid.

Reagents and apparatus

All the reagents and chemicals used were of analytical grade obtained from Sigma Chemical Co and Randox laboratories Ltd authorized distributors in Nigeria. Distilled water and acid washed glassware were used throughout the analysis.

RESULTS AND DISCUSSION

Table 1: The proximate composition of the spices (%)

Sample	Ash	Protein	Crude fibre	Carbohydrate	Fat	Moisture
Tetrapleura tetraptera	9.42	7.80	18.56	54.66	4.45	5.11
Xylopia aethopica	6.97	13.89	9.28	52.94	7.81	9.59
Monodora myristica	6.49	21.69	7.38	41.02	13.24	9.72
Syzygium aromaticum	5.94	11.65	9.06	54.26	9.21	9.88
Chrysobalanus icaco	5.89	6.78	11.24	61.36	4.79	9.94
Afromomum danielli	3.35	10.94	13.00	53.48	7.16	11.63

Table 1 shows the result of the proximate composition of the spices studied, and it was observed that *M. myristica* had the highest protein and fat content out of all the spices that were analyzed; 21.69% and 13.24% respectively. While *C. icaco* had the least 6.78% protein content and *T.tetraptera* had the least fat 4.45%. However, the fat content in *T. tetraptera* was very close to the content in *C. icaco* which was 4.79%. *X. aethopica* had the second highest protein content of 13.89% and this was followed by *S. aromaticum* with a protein content of 11.65%.*T. tetraptera* had the highest ash content of 9.42% and the highest crude fibre content of 18.56%. It also had the second highest carbohydrate content of 54.66% with *C. icaco* having the highest carbohydrate content of 61.36% and the second highest crude fibre content of 11.24%. *A. danielli* had the least ash content of 3.35%, while *M. myristica* had the least crude fibre content of 7.38%. *A. danielli*had the second highest crude fibre content and *M. myristica* had the least carbohydrate content 41.02%. *A. danielli* had the highest moisture content of 11.63% with *T. tetraptera* having the least at 5.11%. The moisture contents of the remaining spices were rather very close ranging from 9.59% in *X. aethopica* to 9.94% in *C. icaco*

These results supports previous studies carried out by Uhegbu *et al*, 2011, where of all spices studied, *M. myristica* had the highest fat content at14.66± 0.03%, which is close to the valueof 13.24% obtained in our laboratory. Also, *T. tetraptera* had the highest ash content of 10.36±0.03%, which is also close to the value of 9.42% obtained in our laboratory for the same sample. Uhegbu *et al* obtained a protein content of 11.90±0.06% for *X. aethopica*to make it the sample with the highest protein content while in our laboratory, it was the second highest protein containing sample at 13.89%.

The high carbohydrate content in all the spices indicates that they can be ranked as carbohydrate rich food sources. The moderate fat content indicates that these spices are not sources of lipid accumulation which can cause artheriosclerosis and aging (Anita *et al*, 2006). Carbohydrate, protein and fat are macro nutrients and as such are needed by the body in large amounts for growth, metabolism and for other body functions. Regular use of plant foods rich in protein makes a valuable addition to a diet (Wardlaw and Kessel, 2002).We need protein for growth (especially important for children, teens, and pregnant women), tissue repair, immune function, making essential hormones and enzymes, energy when carbohydrate is not available, preserving lean muscle mass amongst other things. Fats insulate and protect body organs. It is

also essential for normal growth and development, energy (fat is the most concentrated source of energy), absorbing and transporting certain vitamins (like vitamins A, D, E, K, and carotenoids), maintaining cell membranes, providing taste, consistency, and stability to foods. The minimal intake of carbohydrate is 50 to 100 g per day, 60% of total energy intake is a typical recommendation (Wardlaw and Kessel, 2002). High carbohydrate; low fat diet aids control ofhypertension and prevent obesity. Fat and protein stimulate the release of the hormone –gastric inhibitory peptide (GIP) from the walls of the small intestine. GIP slows the release of stomach contents into the small intestine (Wardlaw and Kessel, 2002). Fiber refers to certain types of carbohydrates that our body cannot digest. These carbohydrates pass through the intestinal tract intact and help to move waste out of the body. Diets that are low in fiber have been shown to cause problems such as constipation and hemorrhoids and to increase the risk of certain types of cancers such as colon cancer. Diets high in fiber; however, have been shown to decrease risks of heart disease, obesity, and they help lower cholesterol.The high chemical content of these spices tend to lend support for the benefits the consumer may derive. Rich macronutrients of food are beneficial to the body (Okaka and Okaka, 2001).

Table 2: phytochemical content of the spices

	Tetrapleura tetraptera	*Xylopia aethopica*	*Monodora myristica*	*Syzygium aromaticum*	*Chrysobalanus icaco*	*Afromomum danielli*
Flavonoids	+	++	+	++	++	++
Anthraquinone	++	++	+	+	+	-
Saponin	+	++	+	++	+	+
Phenol	+	+	+	+	++	++
Tannin	+	+	+	+	+	+
Alkaloid Hager's Test Dragendorff's Test	++ -	+++ ++	++ +	++ -	+++ -	+++ ++
Cardiac glycoside	++	++	++	+	++	++
terpennoid	++	++	+	+	+	+

+++: Very strong presence
++: Strong presence
+: Mild presence
-: Absent

Table 2 shows the result of phytochemical composition of the seeds. They all contain the phytocompounds; Flavonoids, Anthraquinones, Saponins, Phenols, Tannins, Alkaloids, Cardiac glycosides and terpennoids at varying intensities with the exception of *A. danielli* which showed no indication of the presence of anthraquinones. The Dragendorff's test seemed to be a more precise test for the indication of the presence of alkaloids because, from the results, absenceof alkaloids or presence with lesser intensity were indicated with the reagents in cases where Hager's reagent had indicated the presence of the metabolite with a greater intensity. This may be connected with the fact that in the confirmatory test for the presence of alkaloids, using Thin-Layer Chromatography (TLC) method, the chromatogram is eventually sprayed with Dragendorff's reagent to indicate the presence of alkaloids (Sofowora, 1993). Thus, the Dragendorff's test is a more precise test for the presence of alkaloids.

Flavonoid was indicated strongly in *X. aethopica, S. aromaticum, C. icaco* and *A. danielli* while it was mildly detected in *T. tetraptera* and *M. myristica.* Anthraquinone was strongly detected in *T. tetraptera* and

X. aethopica, it wasmildly detected in *M. myristica*, *S. aromaticum*, *C. icaco* and not detected in *A. danielli.T. tetraptera* indicated mild presence of saponin, phenol and tannin, with the presence of alkaloid strong with Hager's test, while it was not detectable using Dragendorff's test. Cardiac glycoside and terpenoid were also strongly detected in *T. tetraptera* and *X. aethopica.* Hager's test for alkaloid indicated a very strong presence in *X. aethopica*, *C. icaco* and *A. danielli*and a strong presence of alkaloid in *M. myristica* and *S. aromaticum*. Dragendorff's test on the other hand indicated a strong presence of alkaloid in *X. aethopica* and *A. danielli*, a mild presence of alkaloid in *M. myristica* and no indication for the presence of alkaloid in *S. aromaticum* and *C. icaco*. Presence of cardiac glycoside was strongly indicated in *M. myristica*,*C. icaco* and *A. danielli* and mildly indicated *M. myristica*, *S. aromaticum*, *C. icaco* and *A. danielli.* saponin was strongly indicated in *X. aethopica* and *S. aromaticum.* It was mild in *T. tetraptera*, *M. myristica*, *C. icaco* and *A. danielli.* The presence of phenol son the other hand was mild in *T.tetraptera*,*X. aethopica*, *M. myristica*, *S. aromaticum* and strong in *C. icaco* and *A. danielli.* The presence of tannin was mild in all the tested spices.

The medicinal value of plants lies in some chemical substances that have a definite physiological action on the human body. Different phytochemicals have been found to possess a wide range of activities, which may help in protection against chronic diseases. Alkaloids protect against chronic diseases such as cancer, it also possesses antimicrobial properties, it is also used in the treatment of malaria, it is used occasionally for the prevention of nocturnal leg cramps caused by vascular spasms amongst others(Kasolo *et al*., 2010).Saponins protect against hypercholesterolemia, and also have a broad spectrum of biological and pharmacological activities such as anti-inflammatory, anti-hepatotoxin, hypoglacemic, antimicrobial and anti-viral activities.(Price *et al.*, 1987, Oakenful and Sidhu, 1989). Although some saponins have been shown to be highly toxic under experimental conditions, acute poisoning is relatively rare both in animals and man. Studies have illustrated the beneficial effects on blood cholesterol levels, cancer, bone health and stimulation of the immune system. Flavonoids are widely distributed in plants fulfilling many functions. They have been shown to have antifungal activity *in vitro* (Galeotti *et al.*, 2008). The potent antioxidant activity of flavonoids reveals their ability to scavenge hydroxyl radicals, superoxide anions and lipid peroxy radicals, this may be the most important function of flavonoids (Alan and Miller, 1996). In addition, flavonoids help to strengthen capillary walls. The compound at times is referred to as phytoestrogens. Phytoestrogens are associated with relief of menopausal symptoms, reduction of osteoporosis, improvement of blood cholesterol levels and lowering the risk of certain hormone-related cancer and coronary heart disease.They also induce mechanisms that may kill cancer cells and inhibit tumor invasion (Williams *et al*., 2004). Tannins are effective in curbing hemorrhages as well as restrict bare swellings. While tannins are proved haemostatic, they are also beneficial when applied on mucosal coating in mouth. Hence, herbs possessing tannins are widely used as mouthwashes, eyewashes, snuff and even as vaginal douches and also treat rectal disorders (Elvin-lewis *et al*., 1977). When applied internally, tannins affect the walls of the stomach and other digestive parts. They sour the mucus secretions and contract or squeeze the membranes in such a manner that secretions from the cells are restricted. Long-term and/or excessive use of herbs/vegetables containing high concentrations of tannins is not recommended (Reed, 1995). As such, the mild presence of tannin in all the spices is beneficial in its medicinal use. Anthraquinones have an irritant laxative effect on the large intestine, causing contractions of the intestinal walls and stimulating a bowel movement and make the stool more liquid thereby easing bowel movements. Cardiac glycoside contains digitoxin, digoxin and ditoxin. It has a strong and direct action on the heart, helping to support its strength and rate of contraction when it is failing.Phenols are strong antioxidants which prevent oxidative damage to biomolecules such as DNA, lipids and proteins which play a role in chronic diseases such as cancer and cardiovascular disease. Plant phenols may interfere with all stages of the cancer process, potentially resulting in a reduction of cancer risk (Hollman, 2001). Terpenoids have been found to be useful in the prevention and therapy of several diseases, including cancer, and also to have antimicrobial, antifungal, antiparasitic, antiviral, anti-allergic, antispasmodic, antihyperglycemic, anti-inflammatory, and immunomodulatory properties (Rabi and Bishayee,2009; Wagner and Elmadfa, 2003; Sultana and Ata, 2008). In addition, terpenoids can be used as protective substances in storing agriculture products as they are known to have insecticidal properties (Theis and Lerdau, 2003).

CONCLUSION

The screening of the spices for their proximate composition and phytochemical constituents shows that apart from having nutritional importance, they also have the potential to act as sources of useful drugs and thereby improving the health status of the consumers as a result of the presence of various phytocompounds that are vital for good health. Thus, validating their medicinal usage by the people of South-East Nigeria.

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