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*Full Length Research Paper*

# Phytochemical and chemical composition of *Combretum zenkeri* leaves

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**Studies on the phytochemical, mineral, proximate and vitamin content of the leaves of *Combretum zenkeri* were carried out. The quantitative phytochemical composition shows that it contains 10.5 ± 1.31 mg/100 g saponin, 7.90 ± 0.10 mg/100 g alkaloid, 4.2 ± 0.10 mg/100 g flavonoid, 31.86 ± 2.10 mg/100 g tannin and 20.088 ± 0.91 mg/100 g cyanogenic glycosides. It contains appreciable level of crude protein, carbohydrate, crude fibre, carbohydrate, ash and crude fat. The macro and micro-minerals obtained includes; 11.477 ± 3.129 mg/100 g calcium, 0.621 ± 0.274 mg/100 g phosphorous, 0.0388 ± 0.953 mg/100 g magnesium, 0.047 ± 0.016 mg/100 g manganese, 0.0083 ± 0.06 mg/100 g iron, 0.008 ± 0.007 mg/100 g zinc, 0.275 ± 0.086 mg/100 g selenium, 17.500 ± 1.44 mg/100 g potassium and 2.000 ± 1.414 mg/100 g sodium. Ascorbic acid was 28.48 ± 0.85 mg/100 g and vitamin A, 9.51 ± 0.11 mg/100 g. This study revealed that *C. zenkeri* is a very good source of phytochemical, minerals, vitamins and macronutrients which, if adequately processed will not only offer medicinal and chemoprotective benefits to its users but could also serve as a good source of nutrients.**

**Key words:** *Combretum zenkeri,* proximate, phytochemical, mineral and vitamin.

## INTRODUCTION

Plants contain many bioactive chemical substances that produce definite physiological and biochemical actions in the human body. These bioactive constituents are alkaloids, tannin, flavonoid, phenolic compounds etc (Hills, 1952; Cho et al., 2004; Edeoga et al., 2005). Plant derived natural products have received considerable attentions in recent years due to the diverse pharmacological properties, including antioxidant and antitumor activity (Karthikumar et al., 2007). In Nigeria many fruits, shrubs, spices and herbs and leafy vegetables are used as food, food drinks and for medicinal purposes (Nwaogu et al., 2007). The use of herbs requires good knowledge of the toxicity, dosage purity, suitable extraction solvent and adverse effects (Paulo et al., 1994; Murray, 1998). *Combretum zenkeri* (family-Combretaceae) is widely distributed and used from Guinea to southern Nigeria and Cameroon. The decoction preparation of the leaves is used as purgative and vermifuge and for the treatment of malaria. In Ivory Coast a piece of the twig is chewed by women to relieve menstrual pain (Kerharo and Bouquet, 1950). Thomas (1974) also reported that the leaves are used by the Igbos in worm-treatment. The plant is used internally and externally for certain oedemas (Bouquet and Debray, 1974). It has also been recorded that habitants of Umuahia South-eastern Nigeria use the leaf as a source of vegetable.

The aim of this study is to determine the fundamental and scientific bases for the use of *C. zenkeri* by quantifying the phytochemical, proximate, minerals and vitamin constituents. This is important because of the increasing demand for medicinal plants and plant products as alternatives to orthodox medicines especially in developing nations. It is hoped that this study will increase interest in them.

## MATERIALS AND METHODS

### Plant sample collection and preparation

The plant leaves of *C. zenkeri* were collected from a farm at Obinze in Owerri-West LGA, Imo-State Nigeria. The plant was identified by

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Dr. Ibeh, a plant taxonomist of the Department of Crop Science, Federal University of Technology Owerri, Nigeria. The fresh leaves were plucked out from the plant stalk, rinsed with clean water and dried for 10 days at room temperature. The dried leaves were ground to fine powder with an electric grinder, packaged in air-tight glass jar and stored at room temperature until analysis was carried out.

#### Phytochemical test

Phytochemical test for the quantitative presence of alkaloids, flavonoids, tannins, saponins, cyanogenic glycosides were done as described by Harborne (1973) and Trease and Evans (1989).

#### Proximate analysis

The proximate composition of the leaf extract for carbohydrate, ash, and moisture were determined as described by AOAC (1995). Crude protein, fibre and fat content were determined by methods as described by Pearson (1976). Total ash content was determined by the method described by James (1995) after incinerating 2.0 g of the processed leaf samples in a furnace at 600°C for 3 h. All determinations were done in triplicates.

#### Vitamin and mineral analysis

Vitamins A and C of *C. zenkeri* were determined by High Performance Liquid Chromatography (HPLC, model CO30). Sodium and potassium were determined by digital flame photometer (model 2655-00). The other minerals; Calcium(Ca), Phosphorous(P), Magnesium(Mg), Manganese(Mn), Iron(Fe), Zinc(Zn) and Selenium(Se) were determined using the Atomic Absorption spectrophotometer (AAS-model-Alpha 4) as descried by AOAC (1995).

#### Statistical analysis

The results obtained are presented as mean ± standard deviation and analyzed as simple percentages.

## RESULTS AND DISCUSSION

Phytochemicals are secondary metabolites of plants known to exhibit diverse pharmacological and biochemical effects on living organisms (Trease and Evans, 1989). The quantitative phytochemical composition of *C. zenkeri* is shown in Table 1. The result shows that it contains 10.5 ± 1.31 mg/100 g saponin, 7.90 ± 0.10 mg/100 g alkaloid, 4.2 ± 0.10 mg/100 g flavonoid, 31.86 ± 2.10 mg/100 g tannin and 20.088 ± 0.91 mg/100 g cyanogenic glycosides. *C. zenkeri* contains appreciable level of alkaloid and flavonoid. These secondary metabolites have been associated with antimicrobial activities and numerous physiological activities in mammalian cells in various studies (Sofowora 1993; Abo et al., 1999; Nweze et al., 2004; Mishra et al., 2009). This supports its use for the treatment of dysentery (Kerharo and bouquet, 1950).

Many plants containing alkaloids and flavonoids have diuretic, antispasmodic, anti-inflammatory and analgesic effects, (Owoyele et al., 2002). This confirms its use internally and externally for the treatment of certain disease disorders like Oedemas, diarrhea, fungal infection, dropsy, gout and swellings (Bouquet and Debray, 1974). However they inhibit certain mammalian enzymatic activities such as those of phosphodiesterase, prolonging the action of cyclic-AMP. Alkaloids also affect glucagons and thyroid stimulating hormones (Okaka et al., 1992). Flavonoids possess anti-inflammatory, antioxidant, anti-allergic, hepatoprotective, anti-thrombic, antiviral and anti-carcinogenic activities (Middleton et al., 2000, Sharma et al., 2009). These properties may explain the use of *C. zenkeri* for worm treatment and the use in Ivory Coast by women to relieve menstrual pain (Kerharo and Bouquet, 1950). Saponin at 10.5 ± 1.31% may be said to be high when compared to saponins content of 3.92 ± 0.11% and 3.10 ± 0.10% from *Physcalis bransilensis,* and *Stachytarpheta cayennensis* repectively, reported by Edeoga et al. (2005).

Saponins possess a carbohydrate moiety attached to a triterpenoid or a steroidal aglycone (Sridhar and Bhat, 2007). Saponin reduces the uptake of glucose and cholesterol at the gut through intra-lumenal physicochemical interactions. This could confer a chemoprotection against heart diseases to users because of the hypocholesterolemic effects (Price et al., 1987). It may also aid in lessening the metabolic burden that would have been placed on the liver. The concentration of cyanogenic glycosides (20.088 ± 0.91 mg/100 g) in *C. zenkeri* is within the permissible limits of 10 - 20 mg/100 g (Abu et al., 2005). This concentration is higher than that recorded for *Albizzia lebbeck* seeds by Anwa et al. (2007) but lower than that recorded for kudzu seeds (Ifeanacho et al., 2007). Cyanogenic glycosides are hydrolyzed by β-glucosidase, producing sugars and a cyanohydrin which spontaneously decomposes to cyanohydric acid (HCN) and a ketone or aldehyde (Harborne, 1993; Ilza and Maria, 2000).

HCN is extremely toxic to a wide spectrum of organisms, due to its ability of linking with metals (Fe++, Mn++ and Cu++) that are functional groups of many enzymes, inhibiting processes like the reduction of oxygen in the cytochrome respiratory chain, electron transport in the photosynthesis, and the activity of enzymes like catalase, oxidase (Cheeke, 1995; McMahon et al., 1995). There is strong evidence that the high concentration of cyanogenic glycosides is one of the defensive mechanisms that protects the plant against predators such as the herbivores. Hydrogen cyanide (HCN) can be significantly reduced by boiling, heating and soaking (Siddhuraju et al., 1996). Tannins are polyphenols and have been reported to exhibit antimicrobial actions. The presence of high level of tannins could confer on the user's chemoprotective benefits (Enechi and Odonwodo, 2003).

The proximate compositions of *C. zenkeri* are given in Table 2. The values showed that it contains high

**Table 1.** Phytochemical composition of *C. zenkeri*.

| Phytochemical | Composition (mg/100 g) |
|---|---|
| Alkaloid | 7.9000 ± 0.10 |
| Flavonoid | 4.2000 ± 0.10 |
| Saponin | 10.5000 ± 1.31 |
| Cyanogenic glycosides | 20.0880 ± 0.91 |
| Tannin | 31.8639 ± 2.10 |

Values are means ± standard deviation of triplicate determinations.

**Table 2.** Proximate composition of *C. zenkeri* leaf (%).

| Nutrients | % Composition |
|---|---|
| Moisture | 11.3250 ± 1.32 |
| Ash | 0.1386 ± 0.03 |
| Crude protein | 20.5398 ± 1.15 |
| Crude fat | 2.2700 ± 0.73 |
| Crude fibre | 17.6300 ± 1.37 |
| Total carbohydrate | 65.7266 ± 1.27 |

Values are means ± standard deviation of triplicate determinations.

**Table 3.** Mineral composition of the leaf *C. zenkeri* (mg/100 g).

| Mineral | Composition |
|---|---|
| Calcium (Ca) | 11.4774 ± 3.1329 |
| Phosphorous (P) | 0.6208 ± 0.274 |
| Magnesium (Mg) | 0.3875 ± 0.953 |
| Manganese (Mn) | 0.0473 ± 0.016 |
| Iron (Fe) | 0.00834 ± 0.06 |
| Zinc (Zn) | 0.0076 ± 0.007 |
| Selenium (Se) | 0.2752 ± 0.086 |
| Potassium (K) | 17.5000 ± 1.414 |
| Sodium (Na) | 2.0000 ± 1.414 |

Values are means ± standard deviation of duplicate determinations.

**Table 4.** The vitamin content of *C. zenkeri*.

| Vitamin (mg/100 g) | Values |
|---|---|
| Vitamin A | 9.51 ± 0.11 |
| Ascorbate | 28.482 ± 0.85 |

Values are means ± standard deviation of duplicated determinations.

percentage of moisture (11.325 ± 1.32%) when compared with an edible vegetable *Ocimum virides* (6.83%) (Okudu, 2007). The moisture content of any food can be used as a measure of its keeping quality. The crude fibre of 17.6300 ± 1.37% is higher than that of *O. virides* (6.30%) but less than that of *Asystasis gangetica* (21.54 ± 0.02%) as reported by Nwaogu et al., 2006. Fibre has some physiological effects in the gastrointestinal tract. These effects include variation in faecal water, faecal bulk and transit time and elimination of bile acids and neutral steroids, which lower the body cholesterol pool. Crude fibre has been reported to reduce the incidence of coronary and breast cancer (Lintas, 1992; Effiong et al., 2009). The protein content (20.5398 ± 1.15%) is slightly lower than the value (25.35%) reported for *A. hybridus* by Nwaogu et al., 2006. The leaf has high carbohydrate content (65.726 ± 1.27%) when compared to both leaves of *O. virides* (48.02%) and seeds of kudzu (51.66%) and *A. hybridus* (29.50%). This explains that *C. zenkeri* leaf is a good source of carbohydrate. Carbohydrates provide energy to cells in the body, particularly the brain, the only carbohydrate dependent organ in the body (Effiong et al., 2009). The Ash (0.138 ± 0.33%) and fat (2.2700 ± 0.73) content are relatively low, when compared with the leaves of *A. gangetica* (8.16 ± 0.02%).

The mineral compositions (Table 3) of *C. zenkeri* are in appreciable concentration. Minerals are known to play important metabolic and physiologic roles in the living system (Enechi and Odonwodo, 2003). It is known that iron, selenium, zinc and manganese strengthen the immune system as antioxidants (Talwar et al., 1989). Similarly, magnesium, zinc and selenium are also known to prevent cardiomyopathy, muscle degeneration, growth retardation, alopecia, dermatitis, immunologic dysfunction, gonadal atrophy, impaired spermatogenesis, congenital malformations and bleeding disorders (Chaturvedi et al., 2004).

The vitamin contents (Table 4) of *C. zenkeri* showed that it contained 28.48 ± 0.85 mg/100 g vitamin C and 9.51 ± 0.11 mg/100 g vitamin A. This vitamin C concentration is higher than 4.17mg/100g reported for *O. virides* by Okudu (2007). The concentration of vitamin A and C will contribute significantly to the daily requirements in view of the reports of Murray (1998) and Trumbo et al., (2004). Vitamin C maintains blood vessel flexibility and improves circulation in the arteries of smokers. The most important benefit claimed for vitamins A and C is their role as antioxidants, in which they scavenge oxygen-free. These chemically active particles are by-products of many of the body's normal chemical processes. Their numbers are increased by environmental assaults, such as smoking, chemicals, toxins, and stress.

## Conclusion

These studies have revealed that *C. zenkeri* is a very good source of phytochemical, minerals, vitamins and macronutrients. This indicates that, a well processed leaves of *C. zenkeri* will offer nutritional, medicinal and

chemoprotective benefits to its users.

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