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*Full Length Research Paper*

# Evaluation of the chemical composition of *Khaya grandifoliola* and *Ficus capensis*

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**Proximate, phytochemicals and mineral elements compositions of *Khaya grandifoliola* (Meliaceae) and *Ficus capensis* (Moraceae) used to treat various types of ailments and diseases such as convulsion, stomach ache, respiratory disorders and threatened abortion, in Nigeria and other African countries were analyzed. The Fresh samples of *K. grandifoliola* and *F. capensis* stem barks were bought from Mushin Herbal Market in Lagos, they were identified and authenticated. The barks of these plants were cut into pieces and oven dried at 45°C and ground to powdery form using Marlex Exceller grinder. The phytochemicals showed the presence of saponins, tanins, alkaloids, anthraquinones, flavonoids, reducing sugars and phlobatanins in these plants. Proximate analysis showed that carbohydrate and proteins were higher, 68.12 ± 0.34 and 8.13% in *K. grandifoliola* and lower, 52.66 ± 0.02 and 3.63 ± 0.03% in *F. capensis*. The fiber and crude fat were higher, 16.38 ± 0.01 and 1.92 ± 0.01% in *F. capensis* and lower 3.05 ± 0.02 and 0.63 ± 0.01% in *K. grandifoliola*. Minerals such as magnesium, calcium, sodium, potassium, magnesium, iron and manganese were higher in *F. capensis* compared to *K. grandifoliola*. The results of this research indicated that the two plants parts have nutritional potentials that could provide the users with additional nutrients aside the conventional uses.**

**Key words:** *Ficus capensis*, *Khaya grandifoliola*, minerals, phytochemicals.

## INTRODUCTION

Medicinal plants contain numerous biologically active compounds such as nutrients and phytochemicals which have physiological actions on the human body (Edeoga et al., 2005; Olowokudejo et al., 2008). The inherent active ingredients are used to cure disease or relieve pain (Okigbo et al., 2008).

*Khaya grandifoliola family* Meliaceae (also called African mahogany, Benin Mahogany, Large-leaved Mahogany, or Senegal Mahogany) is a species of plant in the Meliaceae family. It is found in Benin, The Democratic Republic of the Congo, Ivory Coast, Ghana, Guinea, Nigeria, Sudan, Togo and Uganda. It is used in the form of concoction for the treatment of convulsion, cough, stomach ache, fever, threatened abortion, rheumatism, dermatomycosis and malaria fever in Nigeria (Odugbemi et al., 2007; Olowokudejo et al., 2008).

*Ficus capensis* commonly known as fig tree is also a medicinal plant found in terrestrial zones mostly along rivers. It is a spreading deciduous or evergreen tree with a thick bole and spreading roots. It belongs to the family of Moraceae and it produces fruits throughout the year and the leaves are broad and green (Thomas, 1988; Arnods, 1993). In Nigeria, *F. capensis* has been used for the treatment of dysentery and wound dressing (Igoli et al., 2005). It is also used in circumcision, leprosy and epilepsy, rickets, infertility, gonorrhoea, oedema, respiretory disorders and emollient (Olowokudejo et al., 2008). Furthermore, the leaves and stems bark of the plant have inhibitory effects against *Esherichia coli* and *Shigella* species (Oyeleke et al., 2008). It is also used in herbal medicines to treat threatened abortion (Omonkhelin et al., 2009).

The objective of this present study is to evaluate the nutriational and phytochemical composition of these

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plants; as little or no information is available on this which may link with the ethnopharmacological uses of these plants.

## MATERIALS AND METHODS

### Plant collection and Identification

Fresh samples of *K. grandifoliola* and *F. capensis* stem barks were bought from Mushin Herbal Market in Lagos, Nigeria and identified and authenticated in the Department of Botany and Microbiology, University of Lagos. Voucher specimens (*K. grandifoliola*) BTN237 and (*F. capensis*) BTN238 were deposited in the herbarium.

### Sample preparation

The barks of *K. grandifoliola* and *F. capensis* were cut into pieces and dried in an oven (SD 93114624, Gallenkamp, United Kingdom) at 45°C for 48 h. These were ground to powdery form using Marlex Exceller grinder (Mumbai, India) and stored separately in an airtight container for further analysis.

### Phytochemicals analysis

The presence of saponin, tanins, alkaloids, anthraquinones, flavor-noids, reducing sugars phlobatanins were detected using simple qualitative methods of Trease and Evans (1989) and Sofowora (1993).

#### *Carbohydrate*

0.1 g of the powdered sample each of *Khaya grandifoliola* and *Ficus capensis* was measured into separate beaker and 20mL of distilled water was added, the beaker was heated in a water bath for over 5 min. The mixture was filtered using a filter paper into another beaker to obtain a filtrate, which was used to test for.

#### *Molisch's test for carbohydrate*

Two milliter of the filtrate from the above was measured into a test tube and 2 drops of alcoholic solution α-naphthol added, then the test tube slanted and concentrated sulphuric acid was added down the side of the tube without mixing. A red-violet layer at the interface between the acid (bottom) and aqueous (upper) layers is a positive test for carbohydrate.

#### *Saponin*

Two milliliter of the filtrate from above measured to another test tube and 10mL of distilled water was added, it was shaken vigorously for over a minute. Frothing which persist on warming was observed.

#### *Tannins*

2.5 g each of the powdered sample of *Khaya grandifoliola and F. capensis* was weighed into a conical flask and mixed with 50ml of water, boiled in a water bath for 5 min. The mixture was filtered hot using a filter paper and filtrate collected in a beaker. Two milliliter of the filtrate was mixed with 10mL of distilled water and then a drop of Iron Chloride was added. A blue-black or blue-green precipitate was observed.

#### *Flavonoids*

Five milliliter of dilute ammonia was added to a portion of the aqueous filtrate followed by the addition of concentrated sulphuric acid (1 mL) to 2 mL of potassium hydroxide solution and allowed to mix .Then into acid base mixture a small quantity of aqueous filtrate of the sample was added and observe for colour change.

#### *Anthraquinone*

2.5 g each of powdered samples of Khaya *grandifoliola and Ficus capensis* shaken with 5 ml benzene and then 2.5 ml of 10% ammonia solution was added and shaken. The presence of a pink, red or violet colour in the ammoniacal phase indicates presence of free hydroxyl anthraquinone."

#### *Alkaloids*

Extraction of 5 g of the powdered sample was carried out by boiling in 50 ml of distilled water bath for 30 minutes. It was then filtered into a test tube and filtrate collected, the filtrate was tested with alkaloids reagent, Wagner's and Mayer's reagent and results compared to blank. Turbidity or precipitation was observed with either of the above reagents

### Proximate analysis

The percentage moisture of the dry samples were obtained in oven dehydration (SD 93114624, Gallenkamp, United Kingdom) at 105°C for 3 h and ash content determined using muffle furnace at 550°C for 5 h by official methods 950.46 and 920.153 (AOAC, 2005) respectively. Crude fiber content was determined by Weende methods (AOAC, 2005). While the total nitrogen content was determined using Micro-Kjeldahl methods and the value was multiplied by 6.25 to obtain the amount of crude protein, official method 992.15 (AOAC, 2005). The total carbohydrate content (%) was estimated as: {100 - (%ash + %CF + %CP + % crude fat)} (Okwulchie et al., 2007). Similarly, the gross foods energy (Nutritive value) was estimated using the equation below (Indrayan et al., 2005).

FE (in grams calorie) = (% CP x 4) + (% crude fat x 9) + (% CHOx4)

where
FE –food Energy, CP- Crude Protein, CHO- Carbohydrates, CF-Crude fiber

### Determination of mineral elements composition

The ash solutions of the plant samples were prepared by weighing 5 g of each of the powdered plant samples, these were ashed at 550°C in muffle furnace for 5 h, and the residues dissolved in 100 ml of deionized water. Standard solutions of the minerals (Sodium, Magnesium, Potassium, Calcium, Manganese, Iron and Zinc) to be analyzed were prepared. The atomic absorption spectrophotometer (model 200-A, Buck Scientific) was set with power on for ten minutes to stabilize. The standard minerals solutions were injected to calibrate the AAS using acetylene gas. An aliquot of ash solutions were injected and the concentrations obtained from the

**Table 1.** Phytochemicals composition of *K. grandifoliola* and *F. capensis*.

| Phytochemical composition | *K. grandifoliola* | *F. capensis* |
|---|---|---|
| Alkaloid | + | + |
| Anthraquinone | + | + |
| Phlobatanins | + | + |
| Tanins | + | + |
| Cardiac glycoside | + | + |
| Sugar | + | + |
| Flavonoid | — | + |
| Saponin | + | — |

— Not present + present.

AAS.

**Data analysis**

Data were given to 2 decimal places and were reported as means ± SEM of five determinations. Significant differences between the parameters obtained from Ficus capensis and Khaya grandifoliola were analyzed by Student's t-Test with two tail probabilities of less than 0.05 considered significant using the Microsoft Office Excel (2003).

## RESULTS

The results obtained showed that the two medicinal plants, *F. capensis* and *K. grandifoliola* contain alkaloids, anthraquinone, phlobatanins, tanins, cardiac glycosides and sugar (Table 1). However, flavonoids are not present in *K. grandifoliola* and saponins in *F. capensis* (Table 2). Also, protein, carbohydrates and energy value were significantly ($P < 0.05$) greater in *K. grandifoliola* while the ash content, crude fat and fiber content were significantly ($P < 0.05$) higher in *F. capensis* (Table 3). The minerals, calcium, sodium, potassium, magnesium, iron, manganese were significantly ($P < 0.05$) higher in *F. capensis* compared to *K. grandifoliola*.

**Table 2.** Proximate composition of the barks of *K. grandifoliola* and *F. capensis*.

| Composition | *K. grandifoliola* | *F. capensis* | TTEST |
|---|---|---|---|
| Moisture | 9.9±0.64 | 9.8±0.1 | P>0.05 |
| Ash | 10.14±0.11 | 15.60±0.2 | P<0.05 |
| Protein | 8.13±0.0 | 3.63±0.03 | P<0.05 |
| Crude fat | 0.63±0.01 | 1.92±0.01 | P<0.05 |
| Fiber | 3.05±0.02 | 16.38±0.01 | P<0.05 |
| Carbohydrate | 68.12±0.34 | 52.66±0.02 | P<0.05 |
| Energy value | 310.67±1.61 | 242.44±0.29 | P<0.05 |

Values are mean ± SEM of five determinations on dry weight basis.

**Table 3.** Minerals composition of the barks of *K. grandifoliola* and *F. capensis* in ppm.

| Minerals | *K. grandifoliola* | *F. Capensis* | TTEST |
|---|---|---|---|
| Calcium | 35.04±0.03 | 188.39±0.31 | P<0.05 |
| Sodium | 0.14±0.1 | 16.11±0.06 | P<0.05 |
| Potassium | 11.66±1.29 | 52.50±0.32 | P<0.05 |
| Magnesium | 1.25±0.03 | 6.09±0.05 | P<0.05 |
| Iron | 0.43±0.04 | 2.4±0.03 | P<0.05 |
| Zinc | 2.52±0.02 | 2.32±0.04 | P>0.05 |
| Manganese | 2.03±0.02 | 5.01±0.04 | P<0.05 |

Values are mean ± SEM of five determinations on dry weight basis.

## DISCUSSION

The phytochemical studies revealed the presence of some phytochemicals such alkaloids, tanins, anthraxquinone, phlobatanins, cardiac glycosides and sugars, in *F. capensis*. This corroborate the previous studies done by Oyeleke et al. (2008) and Omonkhelin et al. (2009).

The antimicrobial activity of this plant may be due to the presence of alkaloids (Ebana et al., 1991; Oyeleke et al., 2008) and flavonoids (Alan and Miller, 1996). More so, pure isolated alkaloids and their synthetic derivatives have been used as analgesic, antispasmodic and bactericidal agents (Stary, 1998; Okwu and Okwu, 2004). Flavonoids have been shown to have antibacterial, anti-inflammatory, antiallergic, antimutagenic, antiviral, antineoplastic, anti-thrombotic and vasodilatory activity (Alan and Miller, 1996). Also, flavonoids are of immense medicinal values, it posses antioxidant and anti-inflammatory activity. It has the ability to scavenge hydroxyl radicals, super oxide anions and lipid peroxy radicals (Okwu, 2004; Okwu and Josiah, 2006). Tanins are used in the treatment of wounds emanating from varicose ulcers and hemorrhoids (Nguyi, 1988; Njoku and Akumufula, 2007). It is also used to stop bleeding during circumcision (Joshua, 2006).

Also the phytochemicals analysis of *K. grandifoliola* shows the presence of alkaloids, saponins, tannins, anthraquinone and carbohydrate. This result is consistent

to that obtained by Stephen et al. (2009). While the absence of flavonoids in this study conforms to the work of Ibrahim et al. (2006). The potentials of *F. capensis* to stop bleeding and its use in treating wounds could be as a result of its high calcium and magnesium contents which are needed for bone formation (Okwu and Josiah, 2006). Calcium is very essential in bone and teeth formation, blood clotting, muscle contraction and as a co-factor in certain enzyme catalysis (Robert et al., 2003). The plants contain some amount of sodium and potassium which are principal cations of extracellular and intracellular fluids and help to maintain electrolyte balance in the body (Robert et al., 2003).

The proximate composition of a food is the estimation of the nutritive value in its chemical form. In this study, *F. capensis* and *K. grandifoliola* was shown to contain some amount of carbohydrates; this may serve as a source of energy and may be needed to aid digestion and assimilation of other nutrients. More so, some of the carbohydrates in these plants may be of medicinal value. For instance, α- and β-momorcharins (isolated from seeds of Momordica charantia), momorcochin (isolated from tubers of Momordica cochinchinensis), luffaculin (isolated from seeds of Luffa acutangula) are known to have abortifacient, ribosome inactivating, immunomodulatory, antitumor properties (Ng et al., 1992). The medicinal plants used in this study contain some amount of proteins which can serve many of the medicinal properties exhibited by the plants. For example, a variety of proteins have been isolated in medicinal plants and found to be bioactive against certain ailments (Tsao et al., 1990; Ng et al 1992; Mau et al., 1999). Crude Fiber content of *F. capensis* is higher and nutritionally this is of beneficial effect as food fiber aids absorption of trace elements in the gut and elimination of undigested waste through the bowel (Kelsay, 1981, Abolaji et al., 2007). This may probably explain the reason for the use of the plant to treat constipation (Olowokudejo et al., 2008).

Further work would be done to isolate and characterize some of the active principles against certain diseases.

## Conclusion

This study has provided some information to explain the basis of the ethnomedical uses of *F. capensis* and *K. grandifoliola* for the treatment and prevention of infections. The presence of phytochemicals and nutrients in these plants can add to its therapeutic and nutritional values.

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