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Phytochemical and nutritional profile of *Murraya Koenigii* (Linn) Spreng leaf

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Abstract
Murraya koenigii (Linn) Spreng has been used for flavouring and spicing of food since ancient time. Its medicinal value has also been identified. This work investigated the phytochemical screening, proximate composition, vitamin and mineral contents of the plant leaves using standard procedures. The result of the phytochemical screening revealed the presence of the bioactive constituents comprising flavonoid 7.43 ± 0.03%, phenols 4. 25 ± 0.04%, saponins 2.50 ± 0.01%, alkaloids 1.90 ± 0.01%, tannins 0.86 ± 0.02% and glycosides 0.11 ± 0.01%. The proximate composition was found to be as follows; carbohydrate 39.44 ± 0.04%, moisture content 23.42 ± 0.10%, crude fibre 6.30 ± 0.05%, ash content15.60 ± 0.21%, fats 6.48 ± 0.22% and protein 8.38 ± 0.02%. The analysis of the vitamin content showed the presence of vitamin A (β-carotene) 6.04 ± 0.02 mg/100g, vitamin C (ascorbic acid) 0.04 ± 0.002 mg/100g, thiamin 0.89 ± 0.01 mg/100g, riboflavin 0.09 ± 0.001mg/100g, niacin 2.73 ± 0.02 mg/100g and vitamin E 0.03mg/100g. The plant leaf was found to contain some important minerals; Calcium 19.75 mg/100g, magnesium 49.06 ± 0.02 mg/100g, sodium 16.50 ± 0.21 mg/100g, potassium and zinc 0.04 ± 0.001 mg/100g each. Curry plant leaves contain some substantial amount of important phytochemicals which possess anti-oxidant properties and some nutritive vitamins and minerals thus supporting its use as medicinal plant and as food flavoring and spicing condiment.

Keywords: Phytochemicals, minerals, vitamins, curry leaf, anti-oxidant

1. Introduction
Humans have relied mostly on plants for nutritional and medicinal needs; Herbal plants provide most of the medicinal needs. Important herbal products include spices, herbal teas, functional foods, medicinal raw materials, essential oils, flavouring and dietary supplements [1]. The medicinal use of plant is as a result of the phyto-constituents present in them. Some of these chemicals is bioactive and produce definite physiological and biochemical actions in humans and animals. They are known as secondary metabolites or phytochemicals and comprise alkaloids, flavonoids, tannins, phenolics, saponin, steroids, glycoside, and terpenes etc [2]. The use of plants in traditional medicine is of global interest. Traditional and herbal medicines have been promoted as a source of less expensive and comprehensive medicare especially in developing countries [3]. Some of these medicines are easily available, cheaper and safer than these modern synthetic drugs [4]. This led to the resurgence in the use and demand for medicinal plants as they play roles in prevention and management of some health ailments such as diabetes, cancer, arthritis, degenerative disorders like Parkinson and Alzheimer's diseases [3]. The medicinal values of many plants remain unexploited. Investigations are ongoing to discover novel drugs or templates for the development of new therapeutic agents.
Murraya koenigii commonly known as curry plant belongs to the family Rutaceae. The plant is a medicinal plant and native to India, Sri Lanka and other South Asian countries [1]. It is usually found in tropical and sub-tropical region and cultivated in China, Australia, Nigeria etc. The plant is highly valued for its leaves which are used for flavouring and spicing of food. The curry leaf is believed to have several medicinal properties such as anti-diabetic, anti-oxidant, antimicrobial, anti-inflammatory, anticarcinogenic and hepato-protective properties [5]. Curry leaves have the richest source of carbazole alkaloids such as koenigine, mahanimbine and mu online extracted from the leaves which have been found to demonstrate anti-cancer and anti-oxidant properties [5]. The medicinal values of *Murraya koenigii* are numerous and beneficial to humans, hence this work seeks to evaluate the phytochemical and proximate compositions; vitamin content and minerals elements present in the plant.

2. Materials and Methods

2.1 Sample Collection

The curry plant leaves were purchased from New Market, Ngwa Road, Aba in Aba South L.G.A. Abia state. It was authenticated in the Department of Agricultural Technology, Akanu Ibiam Federal Polytechnic, Unwana, Ebonyi state and deposited in the herbarium with voucher specimen no. MK/00342.

2.2 Sample Preparation: The plant sample was washed and dried on laboratory bench for 3 weeks. It was ground to coarse particles using an electric blender and weighed to be 920g. The sample was later stored until require for analysis. The analyses were carried out in the Chemistry Laboratory of Akanu Ibiam Federal Polytechnic, Unwana. Ebonyi State,

2.3 Phytochemical Determinations

Two grams of sample was defatted with 100ml of diethyl ether.

The phytochemical compounds including: alkaloids, saponins, flavonoids, saponnins, tannins, glycosides and phenols were carried out using method of Harbone [6].

2.4 Proximate Analysis:

Proximate compositions of the plant leaf were analyzed according to the method outline by A.O.A. C. [7].

2.5 Vitamin Content Determination

Vitamins A, C, E, and B-complex vitamins were determined using the method of Okwu and Josiah [8]; A.O A.C [7]

2.6 Mineral Elements Analysis

The sample was first digested. Five gram of sample was digested with perchloric. Then 50mls of nitric acid and 10mls of concentrated sulphuric acid were added. The mixture was then heated until a clear solution was obtained and the mixture reduced to half of its original volume with the aid of hot plate. The mixture was poured into 250 ml volumetric flask and made up to mark with distilled water. The digested sample was then analyzed using Atomic Absorption Spectrophotometer with standards for each mineral element. Sodium and potassium were determined using flame photometer.

3. Results

Table 1: Result of Phytochemical composition of *Murraya koenigii* leaf

Phytochemicals	Values (mg/100g)
Alkaloids	1.90 ± 0.01
Saponins	2.50 ± 0.01
Flavonoids	7.43 ± 0.03
Tannins	0.86 ± 0.02
Phenols	4.25 ± 0.04
Glycosides	0.11 ± 0.01

Values are triplicate determinations and represent in Mean ± STD

Table 2: Result of Proximate composition of *Murraya koenigii* leaf

Proximate compounds	Values (%)
Moisture content	23.4 ± 0.10
Protein	8.38 ± 0.02
Carbohydrate	39.44 ± 0.04
Fats	6.48 ± 0.22
Ash content	15.60 ± 0.21
Crude fibre	6.30 ± 0.05

Values are triplicate and represent in Mean ± STD

Table 3: Result of Vitamin content *Murraya koenigii* leaf

Vitamins	Values (mg/100g)
Vitamin A (B-carotene)	6.04 ± 0.02
Vitamin C (ascorbic acid)	0.04 ± 0.002
Vitamin E (α-tocopherol)	0.03 ± 001
Vitamin B_1 (thiamin)	0.89 ± 0.01
Vitamin B_2 (riboflavin)	0.09 ± 0.002
Vitamin B_3 (niacin)	2.73 ± 0.02

Values are triplicate and represent in Mean ± STD

Table 4: Result of Mineral elements of *Murraya koenigii* leaf

Minerals	Values (mg/100g)
Calcium	19.73 ± 0.02
Iron	0.16 ± 0.01
Magnesium	49.06 ± 0.02
Sodium	16.50 ± 0.21
Zinc	0.04 ± 0.001
Potassium	0.04 ± 0.001

Values are triplicate and represent in Mean ± STD

4. Discussion

The phytochemical compositions of the *Murraya koenigii* leaf shown in Table 1 reveal that flavonoids content was the highest (7.43 ±0.03 mg/100g) while glycoside was detected to be the least. Flavonoids have been shown to possess anti-fungal and anti-bacterial activity [9]. Flavonoids have strong anti-oxidant and anti-inflammatory properties. They have ability to scavenge hydroxyl radicals, superoxide anions and lipid peroxy radicals [10]. These free radicals have been implicated in causing some age-long diseases such as diabetes, cardiovascular, Parkinson and Alzheimer's diseases. The presence of flavonoids in the curry leaf may account for its use in treatment of these diseases. Saponnins was detected in an appreciable amount 2.50 ± 0.01 mg/100g. Saponins are known as immune booster. Plants rich in saponnins have been shown to demonstrate anti-inflammatory, cholesterol lowering and ant-cancer properties [11]. Alkaloid was found to be 1.90 ± 0.01 mg/100g in the curry leaf. Alkaloids have anti-microbial properties owing to their ability to intercalate with DNA of the micro-organisms [12]. Phenol was found to be 4.25 ± 0.04 mg/100g. Urquiaga and Leighton [13] reported that phenols and phenolics have anti-tumour and anti- oxidant effects [13]. They also have anti-inflammatory and anti-carcinogenic properties and play roles in scavenging H_2O_2 by donating electrons to the peroxide thus neutralizing them to water [14].

Table 2 reveals the proximate composition of *Murraya koenigii* leaf. The plant leaves contain a substantial amount of carbohydrate 39.44 ± 0.04% and moisture 23.42 ± 0.10%. This shows that the leaf is a good source of carbohydrate while the moisture content is high indicating a low shelf –life, so the plant material can be preserved by drying it to retain other useful components. The low amount of fat indicates that the vegetable is not a good source of lipid accumulation which can cause atherosclerosis and aging [15]. The proteins in the leaf can make fair contributions to protein diet as proteins are involved in formation of hormones, enzymes and structural membranes. *M. koenigii* contains a good amount of dietary fibre. Dietary fibre lowers cholesterol level, risk of coronary heart disease, diabetes and cancer [16]. Vitamin content of the *M. koenigii* is shown in Table 3. Vitamins are found in trace amounts. Niacin vitamin B_3 was found to be high 2.73 ± 0.02 mg/100g compared to other vitamins. Vitamins A and C were found to be low 6.04 ± 0.02 mg/100gand 0.04 ± 0.02 mg/100g respectively. Niacin helps

to lower and regulate cholesterol level and helps in maintaining good blood circulation [17]. Vitamin A helps to provide good vision and healthy immune system. It also fights cancer by inhibiting the production of DNA in cancerous cells [18]. Vitamins C and E are strong anti-oxidants. They are good in fighting cancer through their scavenging of free radicals. Other B-groups vitamins B_1 thiamine, B_2 riboflavin were also detected. Riboflavin helps in production of red blood cells and is important for growth and healthy body. The presence of these vitamins in the plant leaf has shown that the leaf possesses strong medicinal and nutritive values.

Table 3 gives the mineral content of the curry plant leaf. Magnesium was found to be the highest 49.06 ± 0.02 mg/100g followed by calcium 19.75 ± 0.02 mg/100g while zinc and potassium were found to be low 0.04 ± 0.001 mg/100g each. Mineral and trace elements play important roles in immune function and health. The high content of magnesium proves that the curry leaf can be a good source of magnesium which is an activator of many enzyme systems and maintain electrical potential in nerves [19]. Calcium was detected in an appreciable amount. The *M. koenigii* leaf can serve as food supplement for calcium. Calcium combines with phosphate to enhance strong bone and teeth formation[20]. Sodium content was also found to be high 16.50 ± 0.21 mg/100g. Sodium and potassium are needed in body fluids and nerves for transport and balance. The plant leaf contains zinc, though in small amount, zinc is important in the body as it enhances immunity, cell growth and insulin regulation. It is used in restoring dehydration and stoppage of diarrhea. The presence of the mineral elements in the plant leaf shows that consumption of *M. koenigii* can be used as a supplement for these essential nutrients.

5. Conclusion

This study has shown that *Murraya Koenigii* (curry) leaf used as spice and flavouring agent in food contains substantial amount of phytochemicals and phytonutrients. The proximate analysis showed high content of carbohydrate, protein, fibre and fat. The presence of the vitamins and mineral elements in the plant leaves showed that it could be consumed to supplement these scarce nutrients. With its content of these anti-oxidants flavonoids, phenols, vitamins E and C, curry leaf possess anti-cancer and cardio-protective agents supporting its use as medicinal plant.

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