

*Full Length Research Paper*

# Proximate and nutrient composition of *Euphorbia heterophylla*: A medicinal plant from Anyigba, Nigeria

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Fresh and dried *Euphorbia heterophylla* leaf was assessed for proximate composition and nutrient contents. Phytochemical screening was conducted using standard methods. Proximate analysis (total protein, fats, carbohydrate, ash and moisture contents) were carried out following methods of Association of Official analytical chemist. Macronutrient (Ca, Mg, Na and K) and micronutrients (Ni, Zn, Pb, Fe, Cu and K) were analyzed using atomic absorption spectrometry. The results revealed concentrations of both macro and micronutrients in the plant sample. The elemental composition ranged between  $0.07 \pm 0.01$  to  $446.27 \pm 8.72$  mg/100 g in both fresh and dried sample respectively. Fresh sample contained lower carbohydrate, protein, fat etc than the dried sample. The proximate composition ranged between  $0.7 \pm 0.10$  to  $88.47 \pm 2.68\%$ . Alkaloid, tannins, saponins, terpenoid, flavonoids were found in the plant sample. In conclusion, both samples have higher nutritional as well as medicinal values.

**Key words:** *Euphorbia heterophylla*, proximate composition medicinal plant, macro and micronutrients.

## INTRODUCTION

The use of herbal medicine for the treatment of diseases and infections is as old as mankind. Medicinal plants play a significant role in providing primary health care services to rural people and are used by about 80% of the marginal communities around the world (Prajapati and Prajapati, 2002; Latif et al., 2003; Shinwari et al, 2006). Each medicinal plant species has its own nutrient composition besides having pharmacologically important phytochemicals. These nutrients are essential for the physio-logical functions of human body. Such nutrients and bio-chemical like carbohydrates, fats and proteins play an important role in satisfying human needs for energy and life process (Hoffman et al., 1998; Mathews et al., 1999; Dingman, 2002). Many medicinal plants are used by mar-ginal communities to cure various diseases (Latif et al., 2003; Adnan and Holscher, 2010). As various medicinal plant species are used either in the form of extract or decoction by the local people in different regions,

therefore, evaluating their nutritional significance can help to understand the worth of these plants species in different ecological conditions. Some of these medicinal plants serve as both food and medicine, *E. heterophylla* is one of such plants.

*Euphorbia* plants are widespread in nature ranging from herbs and shrubs to trees in tropical and temperate regions all over the world (Bremer, 1994). The family, *Euphorbiaceae* comprise of 280 genera and 730 species with the largest genus *Euphorbia* having about 1600 species. Generally, they have characteristic milky latex (Mitich, 1992). *E. heterophylla* leaf is used in traditional medical practices as laxative, anti gonorrhoeal, migraine and wart cures. The plant latex has been used as fish poison and insecticide (Rodriguez et al., 1976; Falodun et al., 2003).

The leaves of *E. heterophylla* have been reported to contain quarcetin (Falodun and Agbakwuru, 2004). Diterpenoids have also been reported in the root of *E. heterophylla* (Rowan and Onwukaeme, 2001). The aim of this study was to evaluate the nutritional composition of *E. heterophylla* in Anyigba as it is used in various ways as food drug. At present, little knowledge is available on

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the proximate and elemental composition of *E. heterophylla*.

## MATERIALS AND METHODS

### Plant material

The fresh leaf of *E. heterophylla* were collected from the staff quarters, Kogi State University, Anyigba and was identified at the Botany unit, Department of Biological Sciences, Kogi State University as *E. heterophylla*. The plant leaf was washed with distilled water and oven dried at 60°C to constant weight and ground to powder. Some fresh portion was pounded into paste using laboratory mortar and pestle and used for analysis.

### Phytochemical screening

The crude plant powdered sample was subjected to phytochemical screening testing for the presence of alkaloids, tannins, flavonoids, saponins, following standard procedures (Sofowora, 1993; Harbone, 1973; Trease and Evans, 1989).

### Alkaloids

Extraction of 5 g of the powdered sample was carried out by boiling in 50 ml of distilled water in a water bath for 30 min and filtered. The filtrate was tested with alkaloidal reagents (Dragendorffs, Wagner and Mayers reagents) and results compared with blanks.

### Molisch's test

Powered sample (0.1 g) was weighted into a beaker and 20 ml of distilled water was added. The beaker was heated in a water bath for over 5 min. A portion (2 ml) of the filtrate in a test tube and 2 drops of alcoholic solution of  $\alpha$ -naphthol added, concentrated sulphuric acid added down the side into the test tube. The reaction was observed for color change.

### Flavonoids

Dilute ammonia (5 ml) solution was added to a portion of the aqueous filtrate followed by the addition of concentrated sulphuric acid. A portion (1 ml) concentrated sulphuric acid was added to 2 ml of KOH solution and allowed to mix, then into the acid base mixture, a small quantity of aqueous filtrate of the sample was added and observed for color change.

### Saponins

To 2 ml of the filtrate was added to ml of distilled water, shaken vigorously for 2 minutes and observed for frothing.

### Tannins

Powdered *E. heterophylla* leaves (0.2 g) was weighed into a conical flask and mixed with 50 ml of water, boiled in a water bath for 5 min. The mixture was filtered hot using a filter paper and the filtrate collected in a beaker. A portion (2 ml) of the filtrate was mixed with 10 ml of distilled water and then a drop of iron (III) chloride was added.

### Test for steroids

2 ml of acetic anhydride was added to 0.5 g ethanol extract of each sample with 2 ml H<sub>2</sub>SO<sub>4</sub> the color changed from violet to blue or green in sample indicating the presence of steroids.

### Test for terpenoids (Salkowski test)

Five (5) ml of each extract was mixed in 2 ml of chloroform, and concentrated H<sub>2</sub>SO<sub>4</sub> (3 ml) was carefully added to form a layer. A reddish brown coloration of the interface was formed to show positive results for the presence of terpenoids.

### Elemental assay

The sample was investigated for elemental composition by using Atomic Absorption Spectrophotometer (AAS), Buck scientific model AVG 210. Appropriate working standard solution was prepared for each element. The calibration curves were obtained for concentration versus absorbance. The data were statistically analyzed by using filtering of straight line by least square method. All elements were determined in the medicinal plant (*E. heterophylla*) under this investigation procedure. Laboratory procedures for the preparation and determination of macro and micronutrients were used as outlined by Shah et al. (2009) for plant sample.

### Proximate analysis

The proximate analysis (carbohydrate, fats, protein, moisture and ash) of *E. heterophylla* sample was determined by using AOAC, 1990 method. Carbohydrate was determined by calculation by difference method [100 – (protein + fat + moisture + ash)]. The nitrogen value which is the precursor for protein of a substance was determined by Micro-kjedhal method. The nitrogen value was converted to protein by multiplying to a factor of 6.25 the moisture and ash were determined using weight difference method while determination of crude lipid content of *E. heterophylla* sample was done using Soxhlet type of the direct solvent extraction method. The solvent used was petroleum ether (boiling range 40 - 60°C all the proximate values were reported in percentage (AOACS, 2000; Okwu et al., 2004).

### Statistical analysis

All data were expressed as Mean  $\pm$  S.D and Graph PadIstat-[Data set 1.1SD] was applied.

## RESULTS AND DISCUSSION

The phytochemical screening revealed that *E. heterophylla* leaf both fresh and dried sample, contained important phytochemical such as alkaloids, flavonoids, tannins, terpenoids, saponins etc (Table 1). They were known to show medicinal activities as well as exhibiting physiological activities (Sofowora, 1993). Steroid was found to be present more in the fresh sample than in the dried ones. Most of the phytochemical followed this trend except terpenoids which is scanty in both fresh and dried samples. It should be noted that steroidal compounds are of importance and interest in pharmacy due to their

**Table 1.** Qualitative analysis of the phytochemical of *E. heterophylla* leaf.

Plant sample	Flavonoids	Alkaloids	Saponins	Terpenoids	Steroids	Tannins
Fresh	++	++	++	+	++	+
Dried	+	+	+	+	+	+

+ = present in absorbance, ++ = present in limited amount, - = absent.

**Table 2.** Nutritional values of *E. heterophylla* leaf.

Plant sample	% Moisture	% Ash	% Protein	% Fat	% Fibre	% Carbohydrate
Fresh	88.47 ± 2.68	0.7 ± 0.10	1.38 ± 0.22	1.10 ± 0.05	0.92 ± 0.09	7.39 ± 2.68
Dried	13.88 ± 1.67	1.37 ± 0.08	5.85 ± 0.46	1.25 ± 0.09	3.00 ± 0.18	70.68 ± 2.34

Mean value of three determinations, Mean ± S.D.

relationship with such compound as sex hormones (Oku, 2001). *E. heterophylla* contains tannins and alkaloids and this conforms to the report of Rahila et al. (1994) and Gill (1992). The latter also observed that some of the Euphorbia species including *E. heterophylla* are used as a purgative. They are also used in the treatment of cough, asthma and hay fever (Burkill, 1994; Gill, 1992).

The results of the nutritional compositions are presented on Tables 2 and 3. Table 2 reveals the proximate composition of *E. heterophylla*. The nutrients are more abundant in the fresh sample than the dried hence it is advisable to use the plant sample for both medicinal and food purposes when fresh. On the average, the increasing order of these nutrients in fresh sample is: Ash → fibre → fat → Protein → carbohydrate → moisture. In dried sample Fat → Ash → Fiber → Protein → moisture → carbohydrate. Carbohydrate results demonstrated that both fresh and dry sample with 7.39 ± 2.68 and 70.68 ± 2.34 respectively stand highest percentage when compared to other nutrients except moisture. The plant is a high source of energy and proteins. The protein content of the dried sample is higher than the fresh one. Protein participates in the repair of damaged tissues and could be contributory to the medicinal value of *E. heterophylla*. The results of both macro and micro nutrient composition of *E. heterophylla* are as presented in Table 3. The macronutrients Ca, K, Mg and Na are high in both fresh and dried sample of *E. heterophylla*.

Adequate calcium intake can potentiate the advantage of physical activity (Specker, 1996) and estrogen (Nieves et al., 1998) and on bone. The primary strategies for reducing the risk of osteoporosis are to maximize development of peak bone mass during growth and to reduce bone loss later in life. Adequate calcium intakes are important for both of these aims. The high calcium level in *E. heterophylla* is of advantage medically as it can be used to prevent osteoporosis. Potassium has a crucial

Role in energy metabolism and membrane transport. A major function of potassium is membrane polarization. In

contrast to deleterious effects of high sodium intakes that frequently increase blood pressure, ingestion of more potassium may influence blood pressure favorably by lowering any elevations (Gough et al., 1979). The beneficial effects of potassium (even magnesium and calcium) work, at least in part, though an effect on sodium balance, potassium is more effective in salt sensitive individuals. The level of potassium in this plant is advantageous as it could be a potential agent for blood pressure lowering in high blood pressure condition. On the average the increasing order of the macronutrients in the investigated plant both fresh and dried sample is Na → Mg → K → Ca. It was observed that the concentration of these macronutrients was found more in the dried sample of *E. heterophylla* (Table 3). For micronutrient composition, the increasing order of concentration is Cu → Ni → Cd → Pb → Fe → Zn.

Zinc (Zn) was found at high amount (23.57 ± 0.39 mg/100 g) in the dry sample which falls in the normal range of 25 -150 mg/kg and above the deficiency level of 20 Mg/L (Jones, 1972). The upper toxic limit of Zn in most of the plants is spanning between 100 - 500 mg/L (Macnicol and Beckett, 1985) the phytotoxic Ni concentration is between 40 - 246 mg/L (Gough et al., 1979). This plant therefore is relatively safe. Zinc serves catalytic, structural and regulatory functions in biological systems. The catalytic role of zinc is required for the biological function of 300 enzymes in all 6 classes of enzymes and from different species of all phyla (McCall et al., 2000). Another major function of zinc in metallo-enzyme is the structural role whereby the zinc stabilizes the tertiary structure of the enzymes (Vallee et al., 1991). There is no doubt that the presence of Zn in this plant could be contributory to both its medicinal and nutritional significance claimed by the traditional users.

Copper (Cu) concentrations in both dry and fresh sample of *E. heterophylla* are low. The concentrations are less than the maximum amount of 33 mg/Kg in some plants (Shah et al., 2009). For normal plants growth, 5 - 20 mg/kg concentration of Cu is adequate in plant cells.

**Table 3.** Concentration of elemental nutrients in *E. heterophylla* leaf (Mg/100 g).

Plant sample	Ca	Cd	Cu	Fe	K	Mg	Na	Ni	Pb	Zn
Dried	466.23 ± 8.72	1.1 ± 0.10	0.21 ± 0.02	48 ± 0.13	339.13 ± 11.64	53.61 ± 2.34	9.92 ± 0.66	0.83 ± 0.04	1.03 ± 0.062	23.57 ± 0.39
Fresh	456.10 ± 1.22	1.24 ± 0.05	0.15 ± 0.01	0.83 ± 0.02	364.11 ± 2.88	43.93 ± 1.14	10.36 ± 0.13	0.39 ± 0.03	0.07 ± 0.01	18.11 ± 0.03

Mean value of three determinations, Means ± S.D.

Iron (Fe) concentration was observed more in the dried sample than the fresh one. The observed iron concentration in this plant could justify its use in the management of iron deficiency condition like anemia and this plant could be used as supplement during pregnancy. Supplementation is a standard recommendation and practice in many countries, including United State (Earl and Woeteki, 1993).

## Conclusion

This plant contains vital nutritional and medicinal agents and could serve as functional food. However, for its usage as medicine, professional must be consulted for advice. Further work is needed in the proximate and elemental composition to test its nutritional value which could include feeding experiments using diverse animal species.

## REFERENCES

- Adnan M, Holscher D (2010). Medicinal plant abundance on degrade and reforested site in Northwest Pakstan. J. mt. Res. Dev., DOL: 10. 16 59/mrd- Journal – d -09 00017.1.
- AOAC (1990). Official methods of analysis 15th edition. Association of official analysis chemists, Washington DC, USA.
- AOCS (American Oil Chemist Society) (2000). Official methods of analysis 5<sup>th</sup> edition Association of Official analysis chemists Washington, DC, USA.
- Bremer K (1994). *Asterceae cludistics* and classification, R Timber press Potland Oregon.
- Burkill HM (1994). The useful plants of West Tropical Africa Families A-D Royal Botanical Garden Kew, 1: 441-415.
- Dingman SL (2002). Water in soils: Infiltration and redistribution, physical hydrology, second edition, Upper Saddle River, New Jersey: Prentice-Hall, Inc., p. 646.
- Earl R, Woeteki C (1993). Iron deficiency anemia: recommended guidelines for prevention, detection and management among United States children and women of child bearing age. Washington, DC, National Academy press.
- Falodun A, Agbakwuru EOP, Ukoh GC (2003). Antibacterial Activity of *Euphorbia heterophylla* Linn (family euphorbiaceae) Pak J. Sci. Res., 46(6): 471-472.
- Falodun A, Agbakwuru EOP (2004). Phytochemical analysis and laxative activity of *E. heterophylla* Linn (Euphorbiaceae) Pak. J. Sci. Res., 47(5): 345-348.
- Gough LP, Shacklette HT, Case AA (1979). Element concentrations toxic to plants, animals and man. U.S Geol. Surv. Bull, 80: 1466.
- Harbone JB (1973). Phtochemical methods, London, Chapman and Hall limited. pp. 49-188.
- Hoffman PC, Combs DK, Caster MD (1998). Performance of lactating dairy cows fed alfalfa silage or perennial ryegrass silage. J. Dairy Sci., 81: 162-168.
- Latif A, Almad H, Begun S, Adnan M, Hussian S, Waseen M (2003). Medicinal and other economic plant as substitute to forest logging in Miandam and Sulatant Valleys, Swat. Proceedings of international workshop on conservation and sustainable use of medicinal and aromatic plants in Pakistan.WWF – Pak., pp. 101-105.
- Macnicol RD, Beckett PHT (1985). Critical tissue concentrations of potentially toxic element. Plant soil, pp. 85-107.
- Mathews CE, Van Holde KE, Ahern KG (1999). Biochemistry (3<sup>rd</sup> edn) Benjamin Cummings.
- Mccall KA, Huang C, Fierke CA (2000). Function and Mechanism of zinc metalloenzymes. J. Nutr. 130: 14375–14465.
- Nieves JW, Komar L, Cosman F, Lindsay R (1998). Calcium potentiates the effect of estrogen and calcitonin on bone mass: review and analysis, Am. J. Clin. Nutr., 67: 18–24.
- Okwu DE (2001). Evaluation of the chemical composition of indigenous plant spices and flavoring agents. Global. J. Pure Appl. Sci., 7(3): 455–459.
- Okwu DE, Morah FN (2004). Mineral and nutritive value of *Dennettia tripetala* fruits. Fruits, 59(6): 437–442.
- Prajapati ND, Prajapati T (2002). Sustainable cultivation of medicinal plants, multitier agriculture system – A new concept URL www.techno-preneur.net/timeis/tchnology.
- Rahila T, Rukhsandra N, Zaidi AA, Shamishalia R (1994). Phytochemical screening of medicinal plants belonging to *Euphorbiaceae*. Pak. Vet. J., 14: 160–162.
- Rodriguez E, Twers GHN, Mitchell JC (1976). Biological activities of sesquiterpene lactones. Photochemistry, 15: 1573.
- Rowan NG, Onwukaeme DN (2001). Diterpenoid ester of *Euphobiaceae* in *Euphorbia hyles*. Nig. J. pharmard., 32: 60-64.
- Shah MT, Begun S, Khan S (2009). Peto and Biogeochemical Studies of mafic and intramafic rocks in the Mingora and Kabal areas, Swat, Pakistan. Environmental Earth Sciences, Do1: 10. 1007/5.12665 – 009 – 0253 – 8.
- Shinwari ZK, Pehman M, Watanabe T, Yoshikawa T (1996). A pictorial guide to medicinal plants of Pakistan Kohat University of Science and Technology, Pakistan.
- Sofowora A (1993). Medicinal plants and traditional medicine in Africa spectrum books limited, Ibadan, Nigeria, pp. 150–289.
- Specker BL (1996). Evidence for an interaction between calcium intake and physical activity on change in bone mineral density J. Bone Mineral Res., 11: 1539-1544.
- Trease GE, Evans WC (1989). Pharmacognosy 13<sup>th</sup> edition. Baillier Tindall, London, pp. 176-180.
- Vallee BL, Coleman JE, Auld DS (1991). Zinc fingers, zinc clusters and Zinc twist in DNA – binding protein domains. Proc. Natl. Acad. Sci., USA; 88: 999-1003.