

©IDOSR PUBLICATIONS

International Digital Organization for Scientific Research

ISSN: 2579-0781

IDOSR JOURNAL OF EXPERIMENTAL SCIENCES 1(1): 21-30, 2016.

**The Preliminary Study on the Pharmaceutical Constituents of Methanol Extract of *Costus afer* (Okpete)**

Ikezu U.J.M., Ikpa C.B.C. and Osondu, M.C.

Department of Chemistry, Imo State University, Owerri, Nigeria.

---

**ABSTRACT**

Leaf extract of *Costus afer* of the family Costeaceac which was widely acclaimed ethno medically was worked on to assess the pharmaceutical active ingredients. The phytochemical screening using standard techniques revealed the presence of alkaloids, flavonoids, saponin, tannins, phenols, terpenes, steroids and absence of glycosides. Thin Layer Chromatography of the methanol extract showed two spots with Retardation factors 0.76 and 0.81 respectively. Fourier Transform Infrared Spectra (FTIR) showed the presence of OH, NH of alcohols, phenols or substituents attached to aromatic rings, C=O for amides and ketones, C-N of aliphatic amines, C=C of alkenes and nitriles. GCMS results revealed the presences of 2- (Aziridinylethyl) amine, 3-Floro- $\beta$ , 5-dihydroxy-N-methyl Benzeneethanamine, Dextroamphetamine, (R)-(-)-Amino-1-propanol, Hydroxyurea, Epinephrine, p, $\alpha$ -dimethylphenethylamine which are used in different pharmaceutical applications. These results assured the usefulness of this plant as acclaimed by the local populace.

**Keywords:** Phytochemicals, *Costus afer*, methanol extract, GCMS.

---

**INTRODUCTION**

Medicinal plants play a great role in human life and have substances that are used for traditional, therapeutic and modern drug production purposes in primary health care delivery. Plants continue to be a major source of medicine as they have been throughout human history. So many plant species have been recognized as having medicinal values and properties which may be present in one or all their parts, roots, stem, bark, fruit, leaf, flower, or seed and a large percentage of these plants are found in the forest [1]. Among such plant use medicinally is *Costus afer* Ker-Gawl from the family *Costaceae*, a monocot and relatively tall, herbaceous, unbranched tropical plant with creeping rhizomes. *Costus* plant is among 150 species of stout, perennial and rhizomatous herbs of the genus *Costus* that can be found in moist or shady forest belt of Senegal, South Africa, Guinea, Niger, Sierra Leone, Ghana, Cameroon and Nigeria [2]. It can attain a height up to 4m, its leaves are arranged spirally, simple and entire. The plant is commonly known as ginger lily or bush cane. It is known as “Okpete” or “Okpoto” in Igboland, “Kakizawa” in Hausa “tete-egun” in Yoruba and “Mbriem” in Efik all in Nigeria. Anglophone Cameroon calls it “Monkey sugar cane” [3]. It bears white and

yellow flowers. The stem, seeds, leaves and rhizomes are harvested from the wild plant and they contain several bioactive metabolites. This plant is used as a remedy for cough, respiratory problem, sore throat, inflammation, diarrhea, arthritis, as laxative, aperient, purgative, diuretic, rheumatism, measles, hunch bark and treatment of several other diseases [4]. In Nigeria, the plant extract is used as fodder to treat goats with retained placenta. it has other socio cultural purposes such as wrapping of indigenous food items, mat making, feed to small ruminants. Other species of the genus also have medicinal effects, e.g. *Costus lucanusianus* is used in the Ivory Coast for the treatment of impending abortion. It also exhibits uterine relaxant activity while *Costus schlechteri* is used in the treatment of diabetes mellitus [5].

## EXPERIMENTAL, ISOLATION AND IDENTIFICATION

### PREPARATION OF SAMPLES

Fresh leaves of *Costus afer* were collected from a local farm in Umuehihieokwu in Ikeduru Local Government of Imo state, Nigeria and was identify by Dr. Mbagwu of Plant Science and Biotechnology in Imo State University as *Costus afer* from the family *Costaceae*. The leaves were washed and dried at room temperature, after which it was pulverized and kept ready for use. phytochemical Analysis, Extraction and fractionation were done using standard methods Edeoga and Okoli (2000) [6],[7]. The methanol fraction was analysed further by Thin Layer Chromatography, Fourier Transform Infrared Spectrometry and Gas Chromatography Mass Spectroscopy [8].

### RESULT AND DISCUSSION

The results of the analysis of the active constituents present in the leaves of *Costus afer* are given in Tables 1-4

**Table 1: Result of phytochemical Analysis of Crude sample of *Costus afer* leaves extract**

NO	Phytochemical	Leaf
1	Alkaloids	+
2	Flavonoids	+++
3	Saponins	+
4	Tannins	+
5	Phenols	++
6	Anthraquinones	++
7	Terpenes	++
8	Cardiac glycosides	+
9	Glycosides	-
10	steroids	+

NB: +++ = Highly present, ++ = Moderately present, + = slightly present, -=Absent

**Table 2: Result of Thin Layer Chromatography Analysis of *Costus afer* Crude methanol Leaf extract**

Extract	Number of compounds	R <sub>f</sub> value
Methanol	2	R <sub>1</sub> = 0.81, R <sub>2</sub> = 0.76

**Table 3: Result of FTIR Spectra of Methanol Leaf Extracts of *Costus afar*.**

Wave band Cm <sup>-1</sup>	Description	Types of vibration
1106.21	CN	Stretch of aliphatic amine.
1531.53	NO	Stretch of nitro compound.
1647.26	NH	Bend of primary amine.
2345.52	C = C	stretch of alkenes and nitriles.
3439.19	NH stretch	Of alcohols, phenols or substituent on aromatic rings.
3847.15	O - H or NH	Stretch of alcohol, esters and amides.

**Table 4: Result of Gas Chromatography Mass Spectroscopy (GCMS) Analysis of Methanol leaf Extract of *Costus afer***

COMPOUND NAME	MOLECULAR weight	MOLECULAR FORMULAR	STRUCTURE	RETENTION INDEX	RETENTION TIME	PERCENTAGE CONTENT	BASE PEAK	COMPOUND PEAK
(2-Aziridinylethyl)amine	86	$C_4H_{10}N_2$	-	14533	25.096	83.9	32	7
3-Fluoro-β,5-dihydroxy-N-methyl Benzeneethanamine	185	$C_9H_{12}FNO_2$	-	14308	-	68.6	48	16
Dextroamphetamine	135	$C_9H_{13}N$	-	14989	29.407	13.7	55	-
(R)-(-)-Amino-1-propanol	75	$C_3H_9NO$	-	3386	30.477	18.5	121	21
Hydroxyurea	76	$CH_4N_2O_2$	-	3413	35.703	14.5	152	46
Epinephrine	183	$C_8H_{13}NO_3$	-	3438	29.541	9.86	183	12
	149	$C_{10}H_{15}N$	-	3385	28.573	14.9	149	-
P,α-dimethylphenethylamine								

## DISCUSSION

The phytochemical screening of *Costus afer* showed that the leaves were rich in alkaloids, flavonoids, saponins, phenols, steroid, anthraquinones, terpenoids, while glycosides was absent. This phytochemicals were known to show medicinal activity as well as exhibiting physiological activities and might be responsible for ethno medical claims of the plant. Thin Layer Chromatographic Analysis revealed that the methanol leaf extract has two spots with retardation factors 0.76 and 0.81 respectively. The Infrared spectroscopic result of *Costus afer* (table 3) was a definite indication that some particular functional groups were present in the sample. The vibration peak at  $1106.21\text{cm}^{-1}$  indicated the presence of CN stretch of aliphatic amine while peak at  $1531.53\text{cm}^{-1}$  revealed the presence of NO stretch of nitro compound. The peak at  $1647.26\text{cm}^{-1}$  showed the presence of NH bend of primary amines while absorption peak at  $2345.52\text{cm}^{-1}$  showed C=C stretch of alkenes and nitriles. Absorption peaks at  $3439.19\text{cm}^{-1}$  indicate NH stretch of alcohols, phenols or substituent in on aromatic ring while  $3847.15\text{cm}^{-1}$  indicated the O-H stretch of alcohol, esters and amides [9].

The result of the Gas chromatography mass spectroscopy (GCMS) represented in table (4) showed that presence of seven compounds.

**Compound 1:** which was calculated to be  $\text{C}_4\text{H}_{10}\text{N}_2$  with molecular weight of 86m/z, base peak of 32 and compound peak of 7 was called (2-aziridinyethyl)amine. This compound containing 71% of sample was dictated at the retention time of 25.096min and at retention index of 14533. It was isolated from the class meant for alkaloids which can be used for anti-hypertensive drugs, anti-diuretics drug, anti-diabetic drugs, anti-inflammatory drug[10].

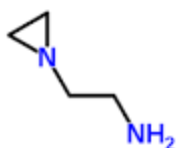


Fig 1: (2-aziridinyethyl)amine.

**Compound 2:** called 3-fluoro-β-5-dihydroxy-n-methyl Benzeneethanamine with molecular weight of 185m/z and 68.6% of the crude extract. The retention index is 14308, The base peak is 48 while the compound peak of 16. This compound is aromatic and it is recorded that most aromatic compounds are widely used pharmaceutically.

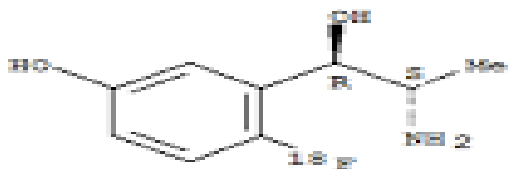


Fig 2: 3-Fluoro-β,5-dihydroxy-N-methyl benzeneethanamine,

**Compound 3:** is called Dextroamphetamine with molecular weight of 135m/z which is calculated to be  $C_9H_{13}N$ , base peak of 55 with the retention index of 14989, retention time is 29.407 has percentage compound of 13.7%. Its drug derivatives is use to treat attention deficit hyperactivity disorder and narcolepsy(a sleep disorder),depression, obesity and nasal congestion. This corresponded with the ethnomedical claim of this plant where it is use locally in treatment of cough(10). It is an aromatic compound and most aromatic compound posses' useful pharmacological properties[11].

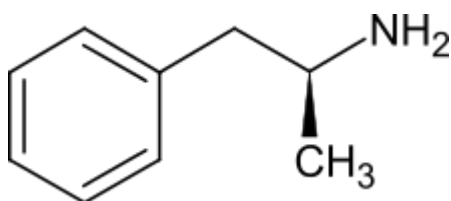


Fig 3: Dextroamphetamine

**Compound 4:** is called (R) -(-) -2-Amino -1-propanol with base peak of 121 and compound peak of 21, has molecular weight of 75, formula is  $C_3H_9NO$ . it contain 18.5% of crude extract at retention time of 30.477minutes and index of 3386. Its drug derivatives is used to treat cold[12] .

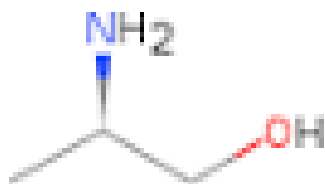


Fig 4: (R) -(-) -2-Amino -1-propanol

**Compound 5:** was calculated to be  $\text{CH}_4\text{N}_2\text{O}_2$  with molecular mass of 76m/z, base peak of 152 and compound peak of 46 was called Hydroxyurea. This compound containing 14.5% of the sample was dictated at the retention time of 35.70min and at index of 3413. It is use for cancer medication[13].

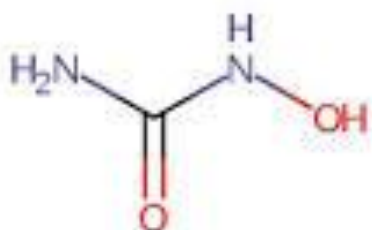


Fig 5: Hydroxyurea.

**Compound 6:** which has molecular mass of 183m/z with formula  $\text{C}_9\text{H}_{13}\text{NO}_3$ , base peak 183 and compound peak 12 was called EPINEPHRINE. This compound has percentage content of 9.86% was dictated at retention time of 29.541min and index of 3438. Epinephrine acts quickly to improve breathing, stimulate the heart, raise a dropping blood pressure, reverse hives and reduce swelling of the face, lips and throat. It is also use locally as anesthetics, cardiac arrest(12) .

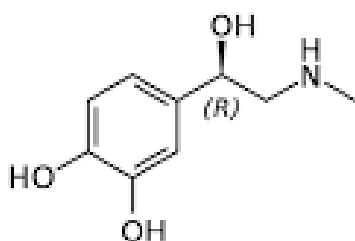


Fig 6: EPINEPHRINE

**Compound 7:** has molecular weight of 149m/z, base peak 149 with the formula  $\text{C}_{10}\text{H}_{15}\text{N}$  which is called p, $\alpha$ -dimethyl Phenethylamine. It has retention time of 28.573, percentage content of 14.9% and index value of 3385. It is an aromatic compound that is used medicinally in treatment of narcolepsy, it can also be used for energy in fatigued individuals . Its structure is shown below:

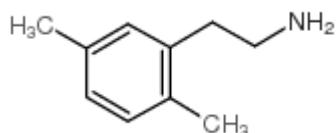


Fig 7: p,α-dimethyl Phenethylamine

### CONCLUSION

The result of the study has shown that *Costus afar* is a potent medicinal plant with many pharmaceutical applications. The result of phytochemical screening revealed the presence of some essential secondary metabolite which include, saponin, alkaloid, flavonoid, tannin,phenols, anthraquinones and terpenes,which are used in the treatment of diseases as recorded by researchers. This research provides an excellent opportunity to create an awareness of the plant, its medicinal value, importance, uses and it's chemical composition, Infrared and GCMS results revealed the chemical compounds that make plant useful for treatment of illness and its importance in pharmaceutical industries. The use of *Costus afer* for treatment of different illnesses is at least in part explainable by the dictated secondary metabolites, chemical composition and their known investigated activities.



## REFERENCES

1. Ajiwe, V.I.E, Dimonyejiaku, N.N, Ajiwe A.C, Chinwuba, A.J and Chendo N.M (2008) Preliminary Study on the Pharmaceutical Constituent of *Emilia sonchifolia* leaf, Anachem journal Vol2(2); 302-309
2. Burkil, H.M.,(1985) The Useful Plant of West Tropic Africa,Royal Botanic Garden K Vol (1)
3. Iwu, M.M.,(1993) Handbook of Medicinal Plants, CRC Press ,Boca Raton, Florida USA, pp. 161-200.
4. Harbone, J.B., (1973) Phytochemical methods. A guide to modern technique in plant analysis champion and Hall, New York,p. 7-41.
5. Vogel, A.I. (1996) Vogel textbook of practical organic chemistry (5<sup>th</sup>edition) Revised by furnis B.S; Hannafiod A.J, Smith P.WG and tatchell A.R, Addison Wesley Longman limited, England, p. 197-319.
6. Edeoga, H. O., and Okoli, B. E., (2000) Chromosome numbers of *Costus lucanusianus* (Costaceae) in Nigeria. *Folia Geobotanica*. **35**:315-8.
7. Ezejiofor, A .N., Orish, C. N. and Orisakwe, O.E., (2013) Effect of aqueous leaves extract of *Costus afer* Ker Gawl (*Zingiberaceae*) on the liver and kidney of male albino Wistar rat, Ancient Science Life;33(1) 4-9
8. Anyasor, G. N., Ogunwenmo, K. O., Olatunji, A. O., and Blessing E. A. (2010), Phytochemical Constituents And Antioxidant Activities Of Aqueous And Methanol Stem Extracts of *Costus afer*. Ker Gawl. (*Costaceae*). African Journal of Biotechnology 9 (31) 4880-4882.
9. Dalziel, K., Round, A., Stein, K., Garside, R., Price, A. (2004). "Effectiveness and cost-effectiveness of hydroxyurea for first-line treatment of chronic myeloid leukaemia in chronic phase: A systematic review and economic analysis". Health technology assessment (Winchester, England) **8** (28): 1-120.
10. Table of IR Absorption [www.chemistry iccsu.edu/glagoviah/teaching/316/ir/table.htm](http://www.chemistry.iccsu.edu/glagoviah/teaching/316/ir/table.htm) retrieved 7/ 8/2014
11. Dextroamphetamine [www.drug.com/cdi/dextroamphetamine.html](http://www.drug.com/cdi/dextroamphetamine.html) retrieved 6/9/2015
12. Hydroxyurea [www.rxlist.com/hydrea-drug.htm](http://www.rxlist.com/hydrea-drug.htm) retrieved 6/9/2015

13. Epinephrine <http://www.udel.edu/chem/C465/senior/fall00/Performance1/epinephrine.htm.html> retrieved 6/9/2015.