International Journal of Modern Chemistry, 2023, 15(1): 30-41

Modern Scientific Press

International Journal of Modern Chemistry **ISSN: 2165-0128**

Journal homepage: www.ModernScientificPress.com/Journals/IJMChem.aspx *Florida, USA*

Article

Phytochemical Constituents and Physicochemical Properties of Medicinal Plant (*Euphorbia hirta)* Leaves

Haruna[1*] S. Y., Isah[2] A. M., Garba[3] A. A., Alkali[4&5] M., Magaji[1] B., Zubairu[1] M. S.

[1]*Department of Pure and Applied Chemistry, Faculty of Physical Sciences, Kebbi State University of Science and Technology, Aleiro, Nigeria*

[2]*Department of Pure and Environmental Chemistry, Usmanu Danfodiyo University, Sokoto, Nigeria.*

[3]*Department of Chemistry, Sokoto State University, Sokoto, Nigeria*

[4]*Department of Pure and Industrial Chemistry, Federal University, Birnin Kebbi, Kebbi State, Nigeria.*

[5]*Department of Inorganic and Organic Chemistry, Biochemistry and Catalysis, University of Bucharest, Boulevard Regina Elisabeta Nr. 4-12, 030018 Bucharest, Romania*

* Author to whom correspondence should be addressed; E-Mail: Sayud7494@gmail.com.

Article history: Received 24 April 2023, Revised 25 May 2023, Accepted 25 May 2023, Published 6 June 2023.

Abstract: In current days medicinal plants play a key role as pillar of traditional healthcare systems of medicine in many developing countries. The investigation was carried out a qualitative test for the possible phytochemical components (Alkaloids, Phenolic compound, Quinone, Protein, Anthraquinones, Saponins, Coumarin, Flavonoids, and Tannin) and quantitative analysis for some selected physicochemical properties after extracting the sample using soxhlet extraction by using ethanol, methanol and Chloroform as extractants. And Phenolic compound, Tannins, flavonoid and Steroid-glycosides are intensively found in the plant. The medicinal use of *Euphorbia hirta* is results from the presence of some active phytochemical constituents. Lastly the physic-chemical properties value is investigated as follow: Mean ash value (%) was 8.00 (total), 0.025 (acid-insoluble ash) and 0.04 (water-soluble ash). The pH of 1% aqueous solution and pH of 10% aqueous solution are 6.52 % and 5.67 % respectively. Useful quantitative and descriptive data essential for identifying and characterizing the plant for the purpose of quality control are presented.

Keywords: *Euphorbia hirta*, physicochemical properties, phytochemical screening and soxhlet extraction

1. Introduction

In current days medicinal plants play a key role as pillar of traditional healthcare systems of medicine in many developing countries. Since from the ancient times, several drugs have been formulated using the bioactive compounds present in these medicinal plants (Rahmati et al., 2015). According to World health organization (WHO) more than 80% world's population depends on medicines derived from these medicinal plants for primary health care needs. The use of medicinal plants as a source for relief from illness can be traced back over since before recorded history. These phyto-medicines are safe and environment friendly (Bansod and Rai, 2008). Phyto-medicines have become increasingly popular and their use is widespread. Plants produce a varied range of bioactive molecules these are called phytochemicals, Phytochemicals are bioactive chemicals of plant origin. They are regarded as secondary metabolites because the plants that make them may have little need for them (Afroz, et al., 2012). These secondary metabolites are synthesized naturally in all parts of the plant body; bark, leaves, stem, root, flower, fruits, seeds, etc. i.e. any part of the plant body may contain active components making them rich sources of different types of phytochemicals. Mostly, these phytochemicals are secondary metabolites like flavonoids, steroids, alkaloids, resins, fatty acids, tannins and phenol compounds, (Wadood et al., 2013). These compounds extracted from different parts of plant. The amount of phytochemical compounds differs significantly from species to species and even from plant to plant, depending on the age and different ecological and climatic conditions. In current years, phytochemicals which have unknown pharmacological activities have been widely investigated as a source of phyto-medicine (Aska, and Kubmarawa, 2016). Phytochemistry or Plant chemistry (the Greek word "Phyto" meaning plant) is the branch of chemistry, deals with chemical nature of the plant or plant products (chemistry of natural products).

Phytotherapy acts as a source of treating and improving certain diseases by using the beneficial effects of medicinal plants (Thilagavathi et al., 2015). Phytochemicals are the bioactive, natural chemical compounds, found in plants. The plant contains a wide variety of chemical compounds and they are broadly classified into two types, primary and secondary constituents. Primary constituents involve chlorophyll, proteins sugar and amino acids whereas secondary constituents contain terpenoids and alkaloids. Due to the presence of these secondary constituent's medicinal plants show antifungal, antibacterial and anti-inflammation activities (Anamika et al., 2010). Different parts such as leaves, bark, seeds, roots, flowers and pods of plants also have different quality and quantity of active constituent.

Euphorbia hirta belong to genus Euphorbia and family Euphorbiaceae. It is a small annual herb and it is common to tropical countries. It can grow to a height of 40cm. Euphorbia hirta is a popular herb in practitioners of traditional herb medicine. Euphorbia hirta is also called asthma herb and pill bearing spurge (Adjeroh et al., 2015). The stem of Euphorbia hirta is slender and other reddish in color and covered with yellowish bristly hair especially in young part of Euphorbia hirta. The leaves of Euphorbia hirta are arranged oppositely and are usually reddish or greenish underneath measuring about 5cm long (Dharmaraj et al., 2019).

This economic important made scientists devote considerable attention for this crops in their research. Several species of Euphorbia, the largest genus in the family "Euphorbiaceae" have attracted; much attention for their antimicrobial, antiviral, antitumor, cytotoxic, pesticidal and phytotoxic activities (Adjeroh et al., 2015).

The esteem of all the drugs is based on phytochemical and pharmacological approaches which widen to drug discovery referred as natural product screening. Any part of the plant may include active components like bark, leaves, flowers, roots, fruits, seeds, etc. The effects of the plant materials results when the secondary products such as phytochemicals get combined. In recent period concentration on plant research has increased all over the world. Plant have played a significant role in maintaining human health and improving the quality of human lifetime for thousands of years and have served humans as well as valuable components of medicines, seasonings, beverages, cosmetics and dyes (Hamad et al., 2013). Phytochemicals are the chemicals produces by plants, of these bioactive constituents of plants are steroids, terpenoids, carotenoids, flavanoids, alkaloids, tannins and glycosides. These compounds have various activities like antimicrobial or antibiotic, some have been reported to shows hemolytic and foaming activities, Anti-inflammatory, fugistatic and molluscidal. Thus the plants have played important role in drug development (Hamad et al., 2013).

The objectives of this study were

- ✓ To investigate chemical composition and physicochemical properties of the crude extract of *Euphorbia hirta*.
- ✓ To conduct preliminary phytochemical screening on *Euphorbia hirta* crude extract
- ✓ To extract the leaf by soxhlet extraction
- ✓ To study physicochemical properties of crude extract.

1.1. Medicinal Plants

Medical plants are of great importance to the health of individuals and communities. The medicinal value of these plants lies in some chemical substances that produce a definite physiological action on the human body.

The most important of these bioactive constituents of plants are alkaloids, tannins, flavondoids, and phenolic compounds (Hill, 1952). Many of these indigenous medicinal plants are used as spices and food plants. They are also sometimes added to foods meant for pregnant and nursing mothers for medicinal purposes (Okwu, 1999; Okwu 2001). Traditional knowledge of medicinal plants has always guided the search for new-cures. In spite of the advent of modern high throughout drug discovery and screening techniques. Traditional knowledge systems have given clues to the discovery of valuable drugs (Buenz et al., 2004). Traditional medicinal plants are often cheaper, locally available and easily consumable, raw or as simple medicinal practices form an integral part of complementary or alternative medicines. Although their efficacy and mechanism of action have not been tested scientifically in most cases, these simple medicinal preparations often mediate beneficial responses due to their active chemical constituents (Park, and pezzutto, 2002). Traditional medicines are used by about 60 per cent of the world population. The nursery for the introduction of food, crop and medicinal plants was created in 1823. And before the introduction of chemical medicines, man relied the healing properties of medicinal plants. Medicinal plants have been identified and used throughout human history in this case medicinal plants are of great importance to the health of individuals and communities (Saravanan et al., 2012)

Today there is growing awareness in chemical composition of plant based medicines. A large number of bioactive constituents have been isolated and studied for medicinal activity (Abu-sayeed et al., 2005). During the last two decades, the pharma industry has made massive investment in pharmacological and chemical researches all over the world to discover much more potent drugs, quite, a few new drugs. Plants have effectively passed the tests of commercial screenings (Anuradha et al., 2008). Considering the vast potentiality of plants as sources for antimicrobial drugs with reference to antibacterial and antifungal agents a systematic investigation was under taken to screen the Phytochemical and antimicrobial activity of leaf and flower of *Euphorbia hirta.* Euphorbia hirta is an important plant for medicinal herb. Euphorbia hirta belong to genus Euphorbia and family Euphorbiaceae (Saravanan et al., 2012). It is a small annual herb and it is common to tropical countries. It can grow to a height of 40cm. Euphorbia hirta is a popular herb in practitioners of traditional herb medicine. Euphorbia hirta is also called asthma herb and pill bearing spurge (Anuradha et al., 2008). The steam of Euphorbia hirta is slender and other reddish in colour and covered with yellowish bristly hair especially in young part of Euphorbia hirta. The leaves of Euphorbia hirta are arranged oppositely and are usually reddish or greenish underneath measuring about 5cm long (Hamad et al., 2013).

2. Materials and Methods

This chapter starts by presenting and discussing about the study area, experimental site and sampling procedure. It also goes through the detailed methodology followed in the experiment such as experimental procedure, materials and reagents used and method of data analysis. Finally, it winds up by specifying the analytical method, and software used.

2.1. Chemicals and Reagents

Analytical grade reagents; Acetic acid, ethanol, ammonium hydroxide, $FeCl_3$, HCl, potassium ferrocyanide, aqueous ethanol, diethyl ether, aqueous sodium chloride, aqueous methanol, acetic anhydride, ethanolic acid, H_2SO_4, chloroform, concentrated H_2SO_4, glacial acetic acid, ferric chloride, and aqueous hydrochloric acid, potassium hydroxide, HNO_3, Phenophthalein, mayer's reagent (potassium mercuric Iodide), and sodum hydroxide.

2.2. Equipment and Apparatus

The following apparatus were used in the study: Beaker, plastic bottle, volumetric flask, test tube, conical flask, separatory funnel, oven, whatman filter paper No 42 (125mm), soxhlet extractor, electronic balance, PH meter, burette, metal stand, pipette, measuring cylinder, condenser, magnetic stirrer, hot plate, moisture disc, crucible, muffle furnace (Nabertherm), mortar and pestle.

2.3. Sample Collection and Preparation

Fresh plant leaves of *Euphorbia hirta* were collected from Kebbi State University of Science and Technology Aleiro in Aleiro Local Government of Kebbi State. The leaves are thoroughly washed with distilled water and dried under shade for 3-5 days. The dried leaves are ground to fine powder and stored in polythene bags for further use (Aska and kubmarawa, 2016).

2.4. Preparation of Extracts

2 grams of dried powder of *Euphorbia hirta* leaves was packed in three separate round bottom flask for sample extraction using three solvents namely ethanol, methanol and Chloroform. The extraction was conducted with 20ml of each solvent for a period of 24 hours. At the end of the extraction the respective solvents were concentrated under reduced pressure and the crude extracts were stored in refrigerator (Asha, 2015).

2.5. Preliminary Phytochemical Screening

The analysis of phytochemicals from the solvent free extract of *Euphorbia hirta* leaves was individually performed using different qualitative tests for alkaloids, flavonoids, saponins, tannins, phenolic compound, coumarins, terpenoids, Quinones, and quinines.

2.5.1. Test for alkaloids (Wagner's Test)

1ml of plant extract was taking and 3-5 drops of Wagner's reagent was added and the formation of reddish brown precipitate or colouration was observed (Bhatia et al., 2018).

2.5.2. Test for flavonoids (Alkaline reagent Test)

1ml of plant extract was take and treated it with 3-5 drops of 20% NaOH solution. Observe for the formation of intense yellow colour, which becomes colourless on addition of 0.5 ml dilute HCl indicates the presence of flavonoids (Dharmaraj et al., 2019).

2.5.3. Test for saponins (Foam test)

Take 1ml of extract and add 5ml distilled water and shake vigorously. Observe for the formation of persistence foam for 10-15 min that confirms the presence of saponins (Ghafoor and Sadiq, 2014).

2.5.4. Test for tannins (Braymer's test)

Take 1ml of extract and treat it with 1ml of 10% alcoholic ferric chloride solution and observe for the formation of blue or greenish colour (Ghodake et al., 2012).

2.5.5. Test for terpenoids (Salkowski Test)

Take 1ml of extract and treat it with 0.5ml of conc. HCl and observe for the formation of yellow precipitate or colouration (Adjeroh et al., 2015).

2.5.6 Test for quinones

Take 1ml of extract and add 5ml distilled water and observe for the turbidity (Mahmoud et al., 2012).

2.5.7. Test for coumarins

Take 1ml of extract and add 1.5ml of 10%NaOH then observe for the formation of yellow colour which indicates the presence of coumarins (Mahmoud and Madany, 2001).

2.6. Determination of Physico-Chemical Parameters

Physicochemical parameters were determined for Euphorbia hirta leaves according to methods described by (AOAC, 2006).

2.6.1. Determination of ash content

The powdered material (5g) was accurately weighed and placed in a crucible. The material was spread in an even layer and it was ignited to a constant weight by gradually increasing the heat to 500-600 °C until it was white indicating the absence of carbon. The residual ash was allowed to cool in a desiccator (Pearson, 2018). The content of total ash of air-dried material was calculated as follows:

$$\text{Ash content}(\%\frac{\text{w}}{\text{w}}) = \frac{(weight\ of\ ash)*100}{weight\ of\ sample}$$

2.6.2. Determination of moisture content

The powdered material (10g) was placed in a moisture dish and dried to a constant weight in an oven at 100-105C (AOAC, 2001). The loss of weight of air dried was calculated as follows:

$$\text{moisture content}(\%\frac{\text{w}}{\text{w}}) = \frac{(initial\ weight\ of\ sample - final\ weight\ of\ sample) * 100}{weight\ of\ sample}$$

2.6.3. Determination of acid insoluble ash

HCl (2 N; 25 mL) was added to the crucible containing the total ash, covered with a watch glass, and boiled gently for 5 min. The watch glass was rinsed with 5 mL of hot water and the rinsed contents were added to the crucible. The acid insoluble matter was collected on an ashless filter paper and washed with hot water until the filtrate was neutral. The filter paper containing acid insoluble matter was transferred to the original crucible, dried on a hot plate, and ignited to a constant weight. The residue was allowed to cool in a desiccator and weighed (Hamad et al., 2013). The content of the acid insoluble ash (in mg/g) of air-dried material was calculated as follows:

$$\text{Acid insoluble Ash}(\%\frac{\text{w}}{\text{w}}) = \frac{(weight\ of\ ash)*100}{weight\ of\ sample}$$

2.6.4. Determination of water soluble ash

Water (25 mL) was added to the crucible containing the total ash, covered with a watch glass and boiled gently for 5 min. The watch glass was rinsed with 5 ml of hot water and added to the crucible. The water insoluble matter was collected on an ash less filter paper and washed with hot water. The filter paper containing the water insoluble matter was transferred to the original crucible, dried on a hot plate, and ignited to a constant weight (Hamad et al., 2013). The water soluble ash content was calculated using the following equation.

$$\text{Water soluble Ash}\ (\%\frac{\text{w}}{\text{w}}) = \frac{(total\ ash - water\ insoluble\ residue\ in\ total\ ash\ )*100}{weight\ of\ sample}$$

2.6.5. Determination of pH

The pH of 1 and 10 % aqueous solution were determined by making appropriate concentration of powdered material in aqueous solution, filtered and checked the pH of the filtrate with a standardized glass electrode, (Anonymous, 2004).

3. Result and Discussion

3.1. Phytochemical Analysis

Table 1 shows the preliminary phytochemical constituents of Ethanol, Methanol and Chloroform of *Euphorbia hirta* leaves. The phytochemical screening of the crude extract revealed the presence of Alkaloids, Flavonoids, and Terpenoids in chloroform, ethanol and methanol. Saponins and Tannins were present in chloroform and ethanol but were absent in methanol. Quinones was present in chloroform and methanol extract but absent in ethanol extract, while Coumarins was absent in chloroform and ethanol but present in remaining extract which showed positive result.

Table 1: The preliminary phytochemical constituents of chloroform, ethanol and methanol extracts of *Euphorbia hirta* leaves

phyto constituents	**Chloroform extract**	**Ethanol extract**	**Methanol extract**
Alkaloids	++	++	++
Flavonoids	+++	+++	+++
Saponins	++	++	+
Tannins	+++	+++	+
Terpenoids	+	+	+
Quinones	+	-	+
Coumarins	-	+	++

The results of the phytochemical analyses showed that Flavonoids were more in quantity than the other phytochemicals tested. Flavonoids, according to the research by may modify allergens, viruses and carcinogens thereby acting like a biological response modifier and acting on bacteria by inhibiting its protein synthesis. Also, *in vitro* studies showed that flavonoids could also possess anti-microbial (Galeotti et al., 2000), anti-allergic and anti-inflammatory properties (Yamamato, and Gaynor 2000).

Phytochemicals such as Coumarins, Saponins, Quinine and alkaloids were found to be moderate in concentration. Steroids are used in the stimulation of bone marrow and growth. It stimulates lean body mass and also play vital roles in the prevention of bone loss in elderly men (De-piccolli et al., 1991).

Phytochemicals such as tannins, saponins, and Steroid-glycosides were found to be relatively low in concentration. Tannins could be an effective ameliorative agent of the kidney (Bajaj, 1998). Tannins have also shown to be potential anti-viral, anti-bacterial and anti-parasitic agents (Liu, 2004). Saponins are used as an adjuvant in the production of vaccines.

3.2. Proximate Analysis

Table 2 represents the physicochemical properties revealed that the plant was erect, with medium green spike-like foliage and white inflorescence. The successive ash value of plant material indicated that the amount of minerals and earthy material attached to the plant material and its value was calculated to be 8.00%w/w. The amount of the acid insoluble ash matter present in the plant was 0.025%w/w. The water soluble extractive value indicated the presence of sugar, acids, and inorganic compounds. The value for loss on drying was found to be 6.00% w/w; less value of moisture content could prevent bacterial, fungal, and yeast growth.

Table 2: The physicochemical parameters of euphorbia hirta leaves

Parameter	**Value**
Ash content (%)	8.00
Moisture content (%)	6.00
Acid insoluble ash(%w/w)	0.025
Water soluble (%)	0.04

3.3. P^H Determination

Table 3 shows the pH values of 1% and 10% solutions were 6.52 and 5.67, respectively.

Table 3: The pH value of euphorbia hirta leaves

pH values of an aqueous solution	**Values**
pH of 1% aqueous solution	6.52
pH of 10% aqueous solution	5.67

4. Conclusions

Phyotochemical analysis of any selected plant species is a very significant way to establish that the selected plant species may be used as potent drugs. In our present study we select commonly found plant *Euphorbia hirta* leaves which is easily available in our campus. It is a well-known medicine for inflammation of respiratory tract and for asthma as it has a special reputation for causing bronchial relaxation. It can also be used as diuretic and purgative action. The above points clearly illustrate that the plants studied here can be seen as a potential source of useful bioactive compounds. In this study, we found that the leaves extract of the plant contain large amount of alkaloids and flavanoids along with terpenoids, saponins, tannins, coumarins and quinones in small ration so these parts of the plant can be used as an important source of phytochemical activity. Further work will give emphasis to the isolation and characterization of active principles responsible for bio-efficacy and bioactivity.

5. Recommendation

The extracts of Euphorbia hirta leaves appeared very attractive materials. Therefore, it has been suggested that the extract can be used for further studies which will lead to possible drug development for diabetes which is relatively inexpensive and less time consuming and more suited to our economic conditions than allopathic drug development.

References

[1] Abu-Sayeed M, Ali MA, Bhattacharjee PK, Islam A, Astaq GRM, Khan M *et al*. *Pakistan Journal of Science and Industrial Research*. 2005, 48:122.

[2] Adjeroh LA, Ajuruchi VC, Nnokwe JC, Azuwike CO, Mgbemena IC (2015) Preliminary phytochemical screening and antimicrobial / antifungal activities of leaf extracts of *Euphorbia hirta. Journal of Natural Sciences Research*, 2015, 5(16).

[3] Afroz RST, Mondal B, Khan R, Ahmed S. *International Journal of Research in Pharmacy and Chemistry*. 2012; 2:1001

[4] Anamika G, Manish K, Rahul K, Kumar V, Rao C, Goel R and Shampa A, Immunumodulatory effect of *Moringa oleifera* Lam. extract on cyclophosphamide induced toxicity in mice, *Indian Journal of Experimental Biology,* 2010, 48: 1157-1160.

[5] Anonymous. *The Wealth of India*. Dictionary of Indian Raw Materials and Industrial Products. Volume IV, Revised Edition, CSIR, Publication and Information Directorate, New Delhi. 2004, 141-6.

[6] Anuradha H, Srikumar BN, Shankaranarayana Rao BS. *Journal of Neural Transmission*, 2008,

115:35.

[7] AOAC, *Official method of analysis of the Association of Official Analytical Chemist*. AOAC International, Arlington (USA), 2001, 934.06.

[8] AOAC, 2006. *Association of Official Methods of Analytical Chemists*, W. Horwitz Editor Eighteen Edition, Washington, DC, USA.

[9] Asha S, Thirunavukkarasu P, Mohamad Sadiq A. Phytochemical screening of *Euphorbia hirta* linn leaf extracts. *World Journal of Pharmaceutical Sciences*, 2015, 2321-3086.

[10] Aska, AS, Kubmarawa D. Preliminary Phytochemical Screening of Some Indigenous Medicinal Plants Used in the Treatment of Tuberculosis in Bauchi State, Nigeria. *IOSR Journal of Applied Chemistry (IOSR-JAC), 2016,* 9(4): 48-52.

[11] Bajaj Y P, Medicinal and aromatic plants, *Biotechnology in Agriculture and Forestry*, Springer–Verlag, Berlin, 1998, pp. 24-25.

[12] Bansod S, Rai M. World Journal of Medicial Science. 2008; 3:81.

[13] Bhatia RK, Gill HS and Mehra SP. Allelopathic potential of some weeds on wheat. *Ind J. Weed Sci*., 2018, 14(2):108-114.

[14] Buenz, I.F.F; schenepple, D.J; and motley, T.J. Technique, biopreospecting historical herbal; texts by hunting for new leads in old tomes. *Trends in pharmacological sciences*, 2004, 25: 494-498.

[15] De-piccolli B, Giada F, Benettin A, Sartori F and Piccolli E, Anabolic steroid use in body builders. An echocardiographic study of left ventricle morphology and function, *International Journal of Sports medicine*, Vol. 1991, 12: 12-408.

[16] Dharmaraj G, Chndra RB, Jaratnam NN and Subramaniam S. Allelopathy of certain weed species. *Madras Agaric. J.* , 2019, 75(3-4): 147-148.

[17] Galeotti F, Barile E, Curir P, Dolci M and Lanzotti V, Flavonoids from carnation of *Dianthus caryophyllus* and antifugal activity, *Phytochemistry letter*, 2008, 1: 44-60.

[18] Ghafoor A and Sadiq M. Critical period of weed crop competition in winter wheat. *Pak. J. Agaric.Res*., 2004, 12 (1):13-23.

[19] Ghodake SD, Jagtap MD and Kanade MB. Allelopathic effect of three *Euphorbia* species on seed germination and seedling growth of wheat. *Schol. Res.Lib. Ann.Biol. Res*., 2012, 3 (10):4801-4803.

[20] Hamad KJ, Ahmed Al-Shaheen SJ, Kaskoos RA, Ahamad J, Jameel M, Mir SR. Essential oil composition and antioxidant activity of *Lavandula angustifolia* from Iraq. *Int. Res. J. Pharm.* 2013, 4(4): 117-20.

[21] Hill AF. *Economic Botany*. A text Book of useful plants and plant prodicts. 2nd edn. Mc Garw-Hill book company lnc, New York, 1952.

[22] Liu R, Potential Synergy of phytochemicals in Cancer prevention. Mechanism of action, *The*

Journal of Nutrition, 2004, 134: 3479-3485.

[23] Mahmoud MY, Madany Ahmed M. Salech. (2001) Department of Botany and microbiology, faculty of science, Cairo University, Giza 12613, Egypt. Annual of agriculture science by Phyototoxicity of *Euphorbia hirta* L. on. *Triticum aestivum.*

[24] Okwu DE. Flavouring properties of spices on cassava futu. *Afr. J. Roots Tubes crops*, 1999, 3(2): 19-21.

[25] Okwu DE (2001). Evaluation of the chemical composition of indigenous spices and flavouring Agents. *Global J. pure Appl. Sci.*7 (3): 455-459.

[26] Park, E.J. and pezzutto, J.M, (2002): Botanicals in cancer chemo preventives. *Cancer and Reviews*, 2002, 21: 231-255.

[27] Pearson, D., *The Chemical Analysis of Food* (8Ed).J. A. Churchill London, 2018, 535.

[28] Rahmati H, Salehi S, Malekpour A, Farhangi F. *International Journal of Molecular Medicine and Advance Science*. 2015, 11:9

[29] Saravanan R, Dhachinamoorthi D, Senthilkumar K, Srilakshmi M, Divya Sri T. *IJRAP*, 2012, 3:439.

[30] Thilagavathi T, Arivindganth R, Vidhya D, Dhivya R. *International Journal of Pharmacy*. 2015, 6:246.

[31] Wadood A, Ghufran M, Jamal SB, Naeem M, Khan A, Ghaffar Ashad R. *Molecules.* 2013, 2:1001.

[32] Yamamato G and Gaynor F, The therapeutic potential of inhibition of NF-Kb pathway in the treatment of inflammation and cancer, *Journal of clinical investigation*, 2000, 107: 2-135.