International Journal of Academic Health and Medical Research (IJAHMR)
ISSN: 2643-9824
Vol. 6 Issue 1, January - 2022, Pages:126-135

Evaluation of Phytochemicals Property and Nutritional Composition of Water Leaf (*Talinum Triangular*) and Blood Leaf (*Justicia Carne*)

Olowoyeye Odunayo James[1], Lawal, Ibraheem Kehinde[2], Owolabi, Oluwafemi Akinkunmi[3], Muraina Taoreed Adekunle[4], Abideen, A. Adekanmi[5], Olajide Oyinloluwa Fisayomi[6]

[1]Department of Science Laboratory Technology,Interlink Polytechnic, Ijebu Jesa, Osun State, Nigeria
E mail: odunayo.olowoyeye@gmail.com
[2]Department of Science Laboratory Technology, Osun State College of Technology, Esa-Oke, Osun Nigeria
E mail: Hearthoyeabi@gmail.com
[3]Department of Science Laboratory Technology, Osun State College of Technology, Esa-Oke, Osun Nigeria
E mail: Oluwafemi.owolabi3@gmail.com
[4]Department of Science Laboratory Technology, Federal Polytechnic Ede, Osun State, Nigeria
E-mail: adekunleade@gmail.com
[5]Raw Materials Research and Development Council, Abuja, Nigeria
E mail: yinklab1234@gmail.com
[6]Department of Science Laboratory Technology, Osun State College of Technology, Esa-Oke, Osun Nigeria
E mail: oyinloluwafisayomi@gmail.com
Corresponding Author: Name; Lawal, Ibraheem Kehinde, Phone; +2347067961623, E-mail; Hearthoyeabi@gmail.com

Abstract: *The water and blood leaves' phytochemical properties and nutritional composition are the subjects of the current investigation. At farms in Esa-Oke, Osun State, water and blood leaves were collected from parent trees. Different standard procedures were used to determine phytochemicals and nutritional analyses. Water leaf contains alkaloid, flavanoids, saponin, and tannins, whereas blood leaf contains alkaloid, flavanoids, and saponin, according to qualitative photochemical analysis.Water and blood leaves have different amounts of alkaloids (6.57±0.28 and 3.40±0.15), flavanoids (0.05±0.01 and 5.32±0.03), saponins (4.41±0.03 and 2.56±0.05), phenols (0.05±0.01 and 4.01±0.02), and tannins (1.38±0.02 and 0.04±0.00) according to quantitative phytochemical analysis. They used their numerous standard procedures to determine the proximate analysis. Proximate analysis revealed the presence of crude protein (31.1±2.04 and 5.30±0.46), crude fat (8.1±1.38 and 6.90±8.74), ash content (12.2±1.79 and 5.93±0.15), moisture content (6.96±2.29 and 63.4±3.77), dry matter (91.6±3.42 and 82.5±5.23), and carbohydrate (38.07 ±5.2 and 23.03±1.64) in both water and blood leaves. Blood leaves and aqueous extracts of water both contain bioactive chemicals that have been found, and they are both suggested as medicinal plants.*

Keywords: Phytochemical, Qualitative, Quantitative, Nutritional composition Water leaf, Blood leaf.

1. INTRODUCTION

In recent years, there has been an increase in global interest in the study of traditional plants and their medical benefits. Because of their significant pharmacological effects, economic feasibility, and low toxicity, the therapeutic qualities of plants have been researched in light of modern scientific advances all over the world (Prashant *et al*., 2010). The present prevalent idea that herbal therapy is safer and more reliable than expensive traditional medicine, many of which may have significant side effects, has sparked a surge in interest in plant-derived pharmaceuticals (Jigna *et al*., 2006).

Plants naturally contain free radical scavenging molecules such as tannins, alkaloids, terpernoids, phenolics, and other metabolites with antibacterial and antioxidant activities, as well as other metabolites (Omoruyi *et al*., 2012). The effects of consuming these natural antioxidants on the immune system, as well as the risks of cardiovascular disease, diabetes, and infections, have been studied (Omoruyi *et al*., 2012).

These phytochemicals are plant metabolites (Sofowurra, 1993) that serve as natural defense systems for host plants while also imparting color, fragrance, and flavor to certain plant sections. When ingested by humans, they are a collection of non-nutrient chemicals that are physiologically active. Many phytochemicals are beneficial to one's health and can help prevent disease (Birt, 2006). Epidemiological and clinical research have shown that phytochemicals found in cereals, fruits, and vegetables play a major role in the prevention of chronic and degenerative diseases in people who eat these foods often (Shahidi, 1996). As a result, there has been a recent rise in the quest for phytochemical ingredients with antioxidant and antibacterial properties (Birt, 2006).

Polyphenols, phenolic acids and derivatives, flavonoids, phospholipids, ascorbic acid, carotenoids, and sterols are examples of phytochemicals that have antioxidant and antibacterial properties. A number of exotic spices with known phytochemical constituents have been shown to be good natural antioxidants (Seifried *et al*., 2007), antimicrobial (Billing and Sherman, 1998), and health-promoting agents (Billing and Sherman, 1998), and health-promoting agents (Billing and Sherman, 1998), and health-promoting agents (Zhou *et al*., 2003).

The vegetable Talinum triangulare (Jacq) Wild, sometimes known as waterleaf, is a member of the Portulacaceae family. It is an erect, succulent herb that grows as a weed in the wild and is occasionally cultivated as a short-lived perennial herb. The mature plant grows to be between 30 and 60 cm tall. Vegetables are plants that are used as side dishes or main courses. They might be aromatic, bitter, or insipid (Edema, 1987).

The plant can be found in West Africa, the West Indies, South America, and other warmer parts of the planet (Adams, 1992). Its widespread acceptability throughout Nigeria's ethnic groupings has earned it a number of local names, including "ngbolodi" (Igbo), "mmon-mmong ikong" (Efik/Ibibio), and "egure" (Yoruba). During the wet season, the plant is grown in a range of environments, including road sides, open fields, and abandoned agricultural sites (Edet and Sunday, 2007).

The nutritional makeup of vegetables varies a great deal. When compared to the starchy foods that make up the majority of a man's diet, they have lower carbohydrate content. Vitamins, vital amino acids, minerals, and antioxidants can all be found in these foods (Fasuyi, 2006). According to Okafor (1983), vegetables are the cheapest and most accessible source of proteins, vitamins, minerals, and essential amino acids. Amaranthus cruentus L., Telfaria occidentalis Hook. F., Gongronema latifolium Benth, Celosia argentea L., Vernonia amygdalina Del., and Talinum triangulare (Jacq) Wild are some of the most important vegetables cultivated in Nigeria. The leaves and delicate stems of T. triangulare are used as dietary supplements in starchy foods, sauces, condiments, spices, and flavorings in the human diet. They're also fed to livestock like rabbits, chickens, swine, and cattle as supplementary feed (Alector and Adeogun, 1995). According to Mensah *et al*. (2008), carbohydrates, protein, ash, lipids, amino acids, moisture, crude fiber, ascorbic acid, pectin, potassium, calcium, magnesium, iron, salt, beta-carotene, and vitamins are all found in the leaves of T. triangulare.

Mensah *et al*. (2008) found that the leaves or roots of T. triangulare are used as diuretics in gastrointestinal disorders, either alone or in conjunction with other therapeutic herbs. Oedema, dropsy, swellings, and scabies are among the illnesses for which the leaves are employed. Aiyeloja and Bello report on the usage of the roots in the preparation of rat poison (2005).

The incidence of life-threatening bacterial infections has increased dramatically over the past two decades. It is a huge public health issue that is becoming more prevalent every day in most countries. Due to the emergence of resistance, a number of clinically useful antibiotics are becoming less effective. Many rural populations lack access to current treatments, and many traditional herbs have not been scientifically proven. The current research looks at the phytochemical and nutrient content of water and blood leaves.

2. METHODOLOGY

2.1 Sample collection and preparation

Water and blood leaves were collected from parent trees on farms in Esa Oke, Osun State, and transported to the Laboratory of the Department of Science and Technology, Esa Oke. The leaves were washed and chopped to remove any dirt. The leaves were sun-dried for 7 days before being pulverized using an electric grinder to achieve a finer milled powder.

2.2. Aqueous Extraction

The plant's aqueous extract was made by weighing 200g of powder on a weighing scale and soaking it in 500ml of distilled water in a one-liter conical flask. It was swirled for 30 minutes before being left for 48 hours. The extract was filtered twice, first with a fine cloth and then with filter paper (Whatman No. 1). In a water bath at 60 °C, the filtrate was put into a round-bottom flask and concentrated by evaporation to dryness (Muyibi and Evison, 2000). The condensed extract was kept in tightly corked, labeled bottles in the refrigerator at 4 °C until it was needed. This was done in accordance with Amin *et al*. (2009).

2.3 Nutritional Composition

Proximate nutrient composition analysis was performed on the freshly prepared samples, with crude protein, crude fat, ash content, moisture content, dry matter, and carbohydrates being the components examined. This was done according to the Association of Official Analytical Chemists' instructions (AOAC, 2002).

2.3.1 Crude Protein

The micro-Kjedahl method was used to complete this task. By digestion with concentrated hydrogen tetraoxosulphate (VI) acid and copper sulphate as a catalyst, the nitrogen proportion of the protein in 5 g of the sample was transformed into ammonium sulphate. The ammonia was collected in a boric acid double indicator solution, and nitrogen was measured using normal hydrochloric acid titration until the end point was achieved. After that, multiplying by a factor of 6.25 gave the amount of crude protein.

2.3.2 Crude Fat

Five grams of plant materials, petroleum ether, and a soxhlet extractor device were used to extract crude fat from the sample. The crude fat content in the samples was calculated using the weight of the fat obtained after evaporating the petroleum ether from the extract, and this was stated as a percentage.

2.3.3 Ash Content

To remove organic components, five grams of the material were put in a crucible and heated to 550 °C. After cooling and weighing the crucible and its contents, the ash was calculated as a percentage of the original dry weight of the samples.

2.3.4 Moisture

The ground sample was weighed to the nearest gram per individual and oven dried at a constant temperature of 70 °C. The amount of moisture in the sample was calculated as a weight loss when it was cooled.

2.3.5 Dry Matter

The fibre content of samples was determined using five grams of defatted samples extracted by acid digestion, filtration, and base digestion. At 550°C, the resultant leftovers were eventually ignited. Fibre content was then represented as a proportion of the initial weight loss after ashing.

2.2.6 Carbohydrate

The difference of 100 of the total of crude protein, fat, ash, and fibre was then used to calculate the amount of carbohydrate in the sample.

2.3 Phytochemical Screening

Standard techniques such as those outlined by Harborne (1973), Sofowara (1993), and Trease and Evans were used to identify phytocomponents in the aqueous extract (1989).

2.4 Qualitative Analysis of the Phytochemicals

2.4.1 Test for Alkaloids

In a steam bath, about 0.5g of each extract was mixed with 5ml of 1% aqueous hydrochloric acid; 1ml of each filtrate was treated with a few drops of Mayer's reagent, and a second 1ml portion was treated similarly with Draggendorff's reagent. As preliminary proof of the presence of alkaloids in the extracts, turbidity or precipitation with either of these reagents was detected (Evans, 1989).

2.4.2 Test for Flavonoids

A portion of the aqueous filtrate of plant extract was treated with 5 ml of diluted ammonia solution, followed by the addition of concentrated sulphuric acid. The presence of flavonoids is indicated by the presence of a yellow hue.

2.4.3. Test for Saponins

In a water bath, about 2 g of powdered sample was cooked in 20 ml of distilled water, and the filtrate was then mixed with 5 ml of distilled water and rapidly shaken for stable, persistent foam. The foaming was combined with three drops of olive oil and vigorously shaken. Saponins are present in the emulsion formation.

2.4.4. Test for phenols by ferric chloride test

A few drops of a neutral 5% ferric chloride solution were added to 50 mg of extract dissolved in 5 ml of distilled water for each sample. The presence of phenolic compounds was indicated by a dark green color (Mace, 1963).

2.4.5 Test for Tannins

In a test tube, 0.5 grams of dried powdered sample was cooked in 20 ml of water and filtered before adding a few drops of 0.1 percent ferric chloride. The presence of tannins is indicated by the presence of a brownish green color.

2.5. Quantitative Analysis of the Phytochemicals

2.5.1. Estimation of Alkaloids

In a 250 mL beaker, 5 g of the sample was weighed. 200 mL acetic acid in ethanol (10%) was added and let to stand for 4 hours. The extract was then filtered and concentrated to one quarter of its original volume in a water bath. To produce precipitation, concentrated ammonium hydroxide was applied to the extract drop by drop. The entire solution was allowed to settle, and the precipitate was collected and filtered after being washed with diluted ammonium hydroxide. The residual is the dried and weighed alkaloid (Harborne and Baxter, 1983).

Formula = B - A × 100 / S

where,

B = Weight of Whatman filter paper.

A = Weight of Whatman filter paper, after drying.

S = Sample weight.

2.5.2 Estimation of Total Flavonoids

The volume was made up to 100 ml with distilled water after 100 mg of tannic acid has been dissolved in a small amount of distilled water (Chun, 2005). By diluting the standard with distilled water, different concentrations of the standard were achieved. The solution's concentration was 100 mg/mL. At zero time, 0.5 ml of aqueous extract sample was diluted with 3.5 ml of distilled water. The tubes were filled with 0.3 mL of 5% sodium nitrate. After five minutes, all of the tubes received 0.3 mL of 10% aluminum chloride. 2 ml of 1 M sodium hydroxide was added to the mixture on the sixth minute. The contents of the reaction mixture were immediately diluted with 2.4 mL of distilled water and properly stirred. The mixture's absorbance was immediately measured at 510 nm in comparison to a prepared blank. Total flavonoids were measured in mg per 100g of edible part, using tannic acid as a reference ingredient.

2.5.3. Estimation of Saponins

A conical flask containing 100 ml of 20% aqueous ethanol was filled with 20 g of sample. At roughly 55°C, the sample was heated for four hours in a hot water bath with constant stirring (Obadoni and Ochuko, 2001). The residue was re-extracted with another 200 mL of 20% ethanol after the mixture was filtered. Over a water bath at roughly 90°C, the combined extract was reduced to 40 mL. The concentrated solution was poured into a 250 mL separator funnel along with 20 mL of diethyl ether and rapidly shaken. The aqueous layer was kept, while the ether layer was discarded, and the purification procedure was repeated. The extract of n-butanol was then added to 60 mL. The extracted n-butanol will be rinsed twice with 10 mL of aqueous sodium chloride. In a water bath, the rest of the solution was heated. The sample was dried to a consistent weight in the oven after evaporation. The percentage of saponins was determined.

Formula = B – A × 100 / S

Where,

B = Weight of Whatmann filter paper.

A = Weight of Whatmann filter paper with sample.

S = Sample weight.

2.5.4. Estimation of Phenols

In the test tubes, 0.5 mL of freshly produced was used. All of the tubes received 8 mL of distilled water. Folin's Ciocalteau reagent (0.5 mL) was also added to each tube. All of the tubes were kept in B.O.D for a 10-minute incubation period at 40°C. The sodium carbonate solution was then added to each test tube at a volume of 1 mL. After that, the tubes were put in the dark for one hour to incubate. At 660 nm, the color formed was spectrophotometrically read. Tannic acid was used to draw the standard curve. In a Shimadzu UV-1650 spectrophotometer, the O.D. was read at 660 nm for different amounts of tannic acid (Malick and Singh, 1980). The standard curve was used to compute the sample concentrations.

2.5.5 Estimation of Tannins

In 100 mL of distilled water, 100 mg of tannic acid was dissolved. Distilled water was used to dilute 5 mL of stock solution to 100 mL, 50 µg of tannic acid in 1 mL.

Extraction of Tannin: The powdered substance was weighed and placed to a 250 mL conical flask, along with 75 mL water. The flask was gently heated and cooked for 30 minutes before centrifuging for 20 minutes at 2,000 rpm and collecting the supernatant in a 100 ml volumetric flask to make up the volume. 1 mL of the sample extract was placed in a 100 mL volumetric flask with 75 mL of water. 5 mL folin denis reagent, 10 mL sodium carbonate solution, and 100 mL water were mixed together and Shake well. After 30 minutes, the absorbance was measured at 700 nm. Make a 1 + 4 dilution of the sample if the absorbance is greater than 0.7. Instead of the sample, water was used to make a blank. A standard graph was created with 100 mg of tannic acid (Robert, 1971). From the standard graph, the tannin content of the sample was estimated as tannic acid equivalent.

2.6. Statistical analysis

Data are expressed as mean ± standard deviation (SD) of triplicates

3. RESULT AND DISCUSSION

3.1 RESULT

3.1.1 Qualitative Photochemical properties of water and blood leave

Table 1 shows the findings of the qualitative phytochemical analysis of leaf extracts from water and blood leaves. In contrast to the presence level observed in blood leaf, the results demonstrate the presence of alkaloids at a moderate level (++) in water leaf. Flavanoids can be found in both the leaves. Saponins are present in water and blood leaves in a considerable amount (++). Both water and blood leaves are devoid of phenolics. Tannins are only found in water leaves and not in blood leaves (Table 1).

3.1.2 Quantitative Phytochemical properties of water and blood leave

The concentration of alkaloids in water leaves was higher (6.57±0.28) than in blood leaves (3.40±0.15) (Figure 1). Blood leaves had more flavanoids (5.32±0.03) than water leaves (3.07±0.12). Saponin is abundant in water leaves (4.41±0.03) but scarce in blood leaves (2.56±0.05). The phenolic content of blood leaves is higher (4.01±0.02) than that of water leaves (0.05±0.01). Water leaf has higher tannin components (1.38±0.02) than blood leaf (Figure 1).

3.1.3 Nutritional composition of water and blood leaves

Crude protein, crude fat, ash content, moisture content, dry matter, and carbohydrates were all investigated in the study. Figure 3 depicts the nutritional components of water and blood leaves. The crude protein content of water leaf (31.1±2.04) is higher than the crude protein content of blood leaf (5.30±0.46). The crude fat content of water leaf (8.1±1.38) is higher than that of blood leaf (6.90±8.74). Water leaf had higher ash content (12.2±1.79), while blood leaf had a lower ash level (5.93±0.15) and 5.80±0.30 figure 4. 2. Water leaves have low moisture content (6.96±2.29) compared to blood leaves, which have high moisture content (63.4±3.77). In this study, water leaf had a dry matter of 91.6±3.42, while blood leaf had a dry matter of 82.5±5.23. Water leaf has higher carbohydrate content (38.07±5.2) than blood leaf (23.03±1.64).

Table 1: Qualitative Phytochemical analysis of the aqueous extract of the leaves of *Talinum triangulare* (Water leaves) and blood leaves (mg/100 g)

S/N	Phytochemicals	Water leaf	Blood leaf
1	Alkaloids	++	+

2	Flavanoids	+	+
3	Saponins	++	++
4	Phenolic	-	-
5	Tannins	+	-

Key (++) = moderately present (+) =present (-) = absent

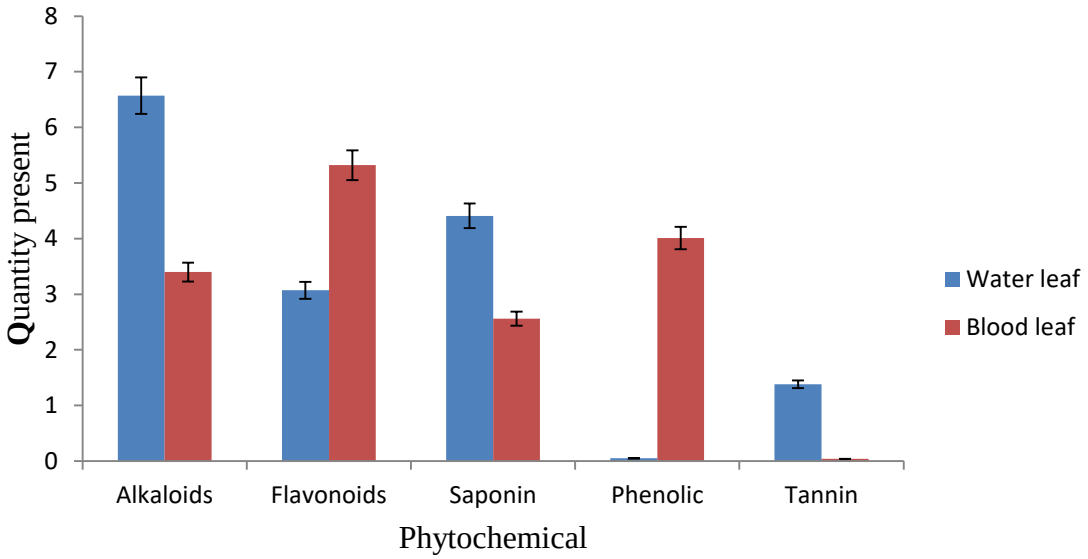

Figure 1: Quantitative Photochemical properties of water and blood leaves

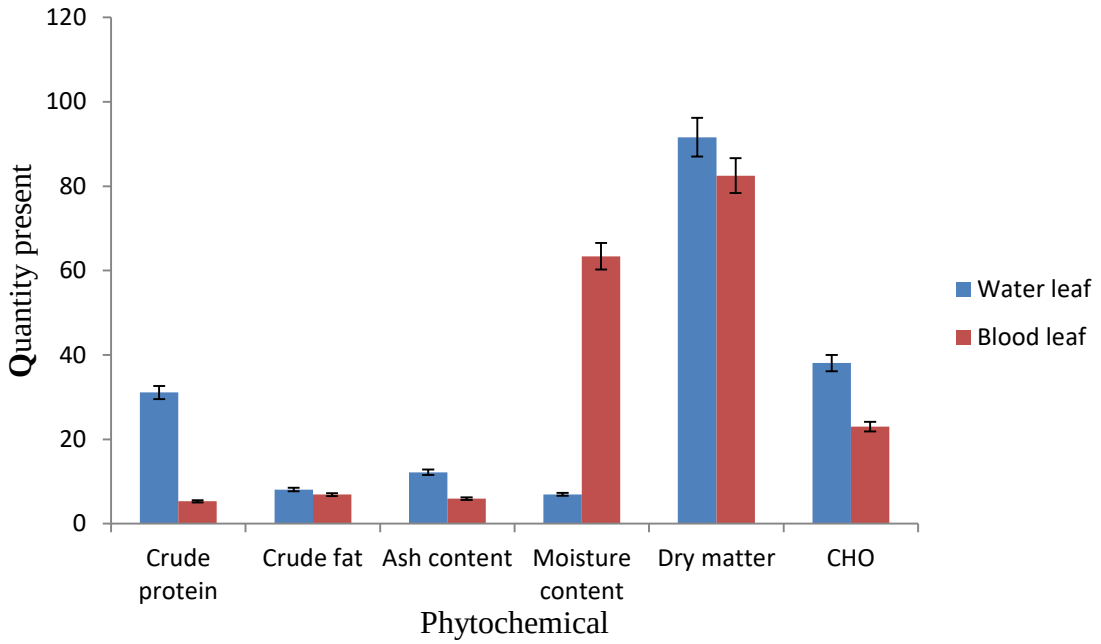

Figure 2: Nutritional composition of water and blood leaves

3.1.2 Discussion

Alkaloids, tannins, phenols, saponins, and flavonoids were found in the leaf extract of Talinum triangulare after phytochemical screening and quantitative calculation of the % yield of phytoconstituent. Leaf extracts of Ocimum gratissimum (Mbata and Saika, 2008) and Ageratum conizoides (Mbata and Saika, 2008) have been found to contain similar bioactive components (Sazada *et al*., 2009). Alkaloids and their synthetic derivatives are utilized as fundamental therapeutic agents for their analgesic, antispasmodic, and antibacterial properties, according to Doherty *et al*. (2010). When given to animals, they become physically active.

Tannins help wounds and irritated mucous membranes heal faster (Okwu and Okwu, 2004). The presence of tannins in blood leaf and T. triangulare leaf extract supports its use in herbal medicine to heal wounds, varicose ulcers, and burns. The presence of phenols in the leaf extract suggests that the plant may have antibacterial properties. According to Okwu (2004), phenols have been widely utilized in disinfection. As a result, *T. triangulare* leaf extract has significant antiseptic and antibacterial activities.

Furthermore, the presence of phenols suggests that blood leaf and T. triangulare leaf extracts may have anti-inflammatory, anti-clotting, antioxidant, immune-enhancing, and hormone-modulating properties (Doherty *et al*., 2010). The antioxidant effects of flavonoids are well-known. Allergies, infections, and cancers are all protected by them (Okwu, 2004). This could explain why blood leaves (*T. triangulare* leaf extract) are used in herbal medicine to treat digestive problems. The presence of saponins in the leaf extract was also discovered. Saponins are bitter and have the ability to foam in aqueous solutions. They also contain hemolytic activity, cholesterol-binding capabilities, and bitterness (Sodipo and Akiniyi, 2000).

Saponins are useful substances for medication production because of their characteristics. This research uncovered the utilization of blood leaves and *T. triangulare* for both nutritional and medicinal objectives. According to Mensah *et al*. (2008) *T. triangulare* leaves or roots have been used to treat gastrointestinal disorders and oedema. Alector and Adeogun report on the usage of *T. triangulare* leaves as a dietary supplement in starchy foods, sauces, condiments, spices, and flavoring in human diets, as well as supplementary feeds for livestock such as rabbits, chickens, pigs, and cattle (1995). These studies back up its utilization in the many communities that were investigated.

T. triangulare has been shown to help reduce the risk of cardiovascular illnesses by Ezekwe *et al*. (1997). Aiyeloja and Bello (2006) described the use of the plant root in the preparation of rat poison. These findings are in line with the conclusions of this investigation. The phytoconstituents and ethnobotany of T. triangulare leaves were investigated in this study.

4. CONCLUSION

Saponins, flavonoids, and alkaloids are present in qualitative photochemical examination of blood leaf, while phenol and tannin are lacking. Saponins, tannins, flavonoids, alkaloids, and tannins are all present in water leaf, but phenol is not. A quantitative phytochemical study of blood and water leaves reveals a wide range of alkaloids, saponins, tannins, flavonoids, and phenols.
Water leaves have more alkaloids, saponin, and tannin than blood leaves, whereas blood leaves have more flavanoids and phenol than water leaves. In water and blood leaves, proximate analysis revealed the presence of moisture, protein, crude fat, crude fiber ash, and carbs. Water leaves have higher crude protein, crude fats, ash content, dry matter, and carbohydrate content than blood leaves. However, blood leaves have higher moisture content than water leaves. Both the usage of water and the application of blood leaves are highly advised.

The findings of this study shed light on why plant material is used in herbal medicine. Triangulare's blood leaves and stems can be used as food and medicine sources. Traditional healers suggest that this herb can be used to treat ailments, and this should be studied. Finally, many beneficial chemicals have been found in aqueous extracts of water and blood leaves. Both of these plants are recommended as medicinal plants.

REFERENCES

Adams, C.D. (1992). Talinum triangulare. Flowering Plants of Jamaica. University of the West Indies, Mona, Jamaica 268 pp.

Aiyeloja A.A and O.A. Bello (2006): Ethno botanical potentials of common herbs in Nigeria: A case study of Enugu State. Educational Research and Review Vol. 1 (1), pp. 16-22. Available online at http://www.academicjournals.org/ERR

Alector, V.A. and Adeogun, O.A. (1995). Nutrients and anti-nutrient components of some tropical leafy vegetables. Intern. Jour. Food Chemistry. 54(4): 375-379.

Amin, K. M. Y, Khan, M. N. Rahmans, Z. Khan, N. A. (2009). Sexual function improving effect of Mucuna pruriens in sexual normal male rats. Fitoterapia. 67:53-58

AOAC International. Official Methods of Analysis of the AOAC, 18th edn. (Horwitz W., editor. ed.). Washington D.C., 2002. USA: AOAC International

B. E. Omoruyi, G. Bradley, and A. J. Afolayan, "Antioxidant and phytochemical properties of *Carpobrotus edulis* (L.) bolus leaf used for the management of common infections in HIV/AIDS patients in Eastern Cape Province," *BMC Complementary and Alternative Medicine*, vol. 12, article 215, 2012

Billing, J. and Sherman, P. W. (1998). Antimicrobial functions of spices: why some like it hot. Quality Review Biology 73 (1): 3 – 39 (PubMed).

Birt, D. A. (2006). Phytochemicals and cancer prevention: from epidemiology to mechanism of action. Journal of the American Dietetic Association 106: 20 – 24.

Chun, O.K., Kim, D-O., Smith, N., Schroeder, D., Han, J.T. and Lee, C.Y.2005.Daily consumption of phenolics and total antioxidant capacityfrom fruit and vegetables in the American diet.Journal of the Science ofFood and Agriculture.**85**:1715-1724

Doherty, V.F., Olaniran, O.O. and Kanife, U.C. (2010). Antimicrobial Activities of Afromomum meleguata. Intern. Jour. Biology 2(2): 126-131

Ebong;G Akpan, MM; Mkpenie, VN . Heavy Metal Contents of Municipal and Rural Dumpsite Soils and Rate of Accumulation by Carica papaya and Talinum triangulare in Uyo, Nigeria. E-Journal of Chemistry, 2008, 5 (2): 281-290

Edema, A.O. (1987). Production of some common vegetables. Horticultural Research Institute, Ibadan, Nigeria. pp 1-5.

Edet, J.U. and Sunday, B.A. (2007). Measuring technical efficiency of waterleaf (Talinum triangulare) production in AkwaIbom State, Nigeria. Jour. Agric. and Environ. Science 2(5): 518-522.

Ezekwe, M.O., Besong, S.A., Igbokwe, P.E. and Ezekwe, E.I. (1997). Food compositions comprising purslane leaves and methods of using thereof. Annals of Bot. 92: 393-399.

Fasuyi, A.O (2006). Nutritional potentials of some tropical vegetables leaf meals: Chemical characterization and functional properties. African Jour. Biotech. 5(1): 49- 53.

Harborne, J.B. 1973. Phytochemical method, London Chapman and Hall, Ltd.,pp. 49-188.

Harborne, J.B. and Baxter, H. 1983. Phytochemical dictionary.A handbook ofbioactive compounds from plants. Taylor and Frost, London. p. 791

Jigma P., Sumitra G(2006). *In-vitro* antimicrobial activities of extracts of *Launea procumens* Roxb. (*Labiateae*) vitis vinitera L. (*Vitaceae*) and *Cyperus rotundus* L. (Gyperaceae). Afri J. Biomed, 9: 89-93

Jigma P., Sumitra G(2006). *In-vitro* antimicrobial activities of extracts of *Launea procumens* Roxb. (*Labiateae*) vitis vinitera L. (*Vitaceae*) and *Cyperus rotundus* L. (Gyperaceae). Afri J. Biomed, 9: 89-93

Malick, C.P. and Singh, M.B. 1980. Plant enzymology and histoenzymology.Kalyani Publisher, New Delhi. p. 286.

Mbata, T.I. and Saika, A, (2008). Antimicrobial activity and phytochemical screening of crude ethanolic extract of leaves of Ocimum gratissimum L. on Listeria monocytogenes. The Internet Jour. Microbiol. 4(2): 1-13.

Mensah,J., R.I. Okoli, J.O. Ohaju-Obodo and K. Eifediyi,. Phytochemical, nutritional and medical properties of some leafy vegetables consumed by Edo people of Nigeria. Afr. J. Biotechnol.,2008, 7: 2304-2309

Muyibi, S. A. and Evison, L. M. (2000). Optimizing physical parameters affecting coagulants of turbid water with Moringa oleifera seeds. Water. Resources 29:2689-2695

Obadoni, B.O. and Ochuko, P.O. 2001. Phytochemical studies and comparativeefficacy of the crude extracts of some homostatic plants in Edo andDelta states of Nigeria.Global Journal Pure and Applied Sciences.**8**: 203-208.

Ojiako,I ., G.N. Asumugha, C. Ezedinma and N.E. Uzokwe . Analysis of production trends in the major root and tuber crops in Nigeria, 1961-2005. Research on Crops, 2007 8(2): 371-380.

Okafor, J.C. (1983). Horticulturally promising indigenous wild plant species of the Nigerian forest zone acts. Horticulture 123: 165-177.

Okwu, D.E. (2004). Phytochemicals and vitamin content of indigenous spices of South Eastern Nigeria. J. Sustain. Agric. Environ. 6: 30-34.

Okwu, D.E. and Okwu, M.E. (2004). Chemical composition of Spondias mombia Linn plant parts. J. Sustain. Agric. Environ.6: 140-147.

Prashant, T., Bimlesh, K., Mandeep, K., Gurpreet, K. and Harleen, K. (2011). Phytochemical screening and extraction: A review. Internationale Pharmaceutica Siencia, 1 (10): 998-1006.

Robert MC,(1971). Stereochemistry of the enzymic cyclization of copalyl pyrophosphate to kaurene in enzyme preparations from Marah macrocarpus.J Am Chem Soc; 102:6358-9.

Sazada, S., Arti, V., Ayaz, A.R., Faraha, J. and Mukesh, K.M. (2009). Preliminary phytochemical analysis of some important medicinal and aromatic plants. Advances in Biological Research 3(5-6): 188-195.

Seifried, H.E., Anderson, D.E., Fisher, E.I. and Milner, J.A. (2007). A review of interaction among dietary antioxidants and reactive oxygen species. Journal of Nutrition and Biochemistry 18 (19): 567-79 (Pub Med).

Shahidi, E. (1996). Natural antioxidants chemistry, health effects and applications. Champmaign 111; AOAC Press. 241p.

Sodipo, O.A. and Akiniyi, J.A. (2000). Studies on certain characteristics of extracts from bark of Pansinystalia macruceras (K. Schum). Global J. Pure and Applied Sciences 6: 83-87

Sofowora A. (1999) Medicinal plant and traditional medicine in Africa. 2nd Edition, Spectrum Books Limited. Ibadan, ;178-188

Trease GE, Evans WC. Pharmacognsy. 11th edn. Brailliar Tiridel Can. Macmillian publishers, 1989

Zhou H, Jiang SH, Tan CH et al (2003a) New epoxyserratanes from *Huperzia serrata*. Planta Med 69:91–94