World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

Check for updates

Evaluation of antinutritional, phytochemical and mineral composition of *Strobilanthes alternata leaves* in Ikot Ekpene LGA of Akwa Ibom State, Nigeria

Kufre Edet Essien [1,*], Eno Sunday Udo [2], Okon Effiong Okon [2] and Aniekan Ekpenyong Owen [1]

[1] *Department of Chemistry, Akwa Ibom State University, Mkpat Enin, Nigeria.*
[2] *Department of Science Technology, Akwa Ibom State Polytechnic, Ikot Osurua, Akwa Ibom State, Nigeria.*

World Journal of Advanced Research and Reviews, 2022, 14(02), 598–602

Publication history: Received on 19 April 2022; revised on 22 May 2022; accepted on 25 May 2022

Article DOI: https://doi.org/10.30574/wjarr.2022.14.2.0462

Abstract

Plant leaves play an essential part in health service as source of medicines. Since ancient age, plants are exploited as medicinal source. Various medicinal plants and their purified constituents have exposed helpful therapeutic potentials. The present study revealed the nutritional and *antinutritional* content of *S. alternata* which are known to possess the active medicinal chemical constituents. *S. alternata* has high content of the following essential minerals; Calcium, and Sodium with the following concentrations; 15.82 ± 0.01mg/100g and 10.55 ± 0.01 mg/100g, respectively. While relative amount of Potassium (5.89 ± 0.03mg/100g), Phosphorus (3.97 ± 0.02mg/100g) and Magnesium (6.29 ± 0.02mg/100g) were found to be present in the sample. The presence of Phytochemicals; Saponins, Alkaloids, Flavonoids Tannins and Hydrogen cyanide were evaluated to be 5.23± 0.01 mg/100g, 5.54 ± 0.0102mg/100g, 31.60 ± 0.0202mg/100g, 12.59 ± 0.0102mg/100g and 10.11 ± 0.0102mg/100g respectively. Anti-nutritional factors were recorded, thus; Phytate (5.37 ± 0.02 mg/100g), Oxalate (2.95 ± 0.01 mg/100g), Tannin (4.29 ± 0.01 mg/100g) and Cynogenic glyconide (7.53 ± 0.01 mg/100g). The presence of these phytochemicals and minerals point to the medicinally and nutritionally potent and should be used in the pharmaceutical industries for the formulation of drugs. All the anti-nutrient concentrations found exceeded the acceptable levels for human and animal consumption. However, the levels of anti-nutrients can be reduced through traditional processing techniques such as boiling, steaming, and cooking to make it safer for drugs development.

Keywords: Phytochemicals; Antinutrients; *Strobilanthes alternata*; Nutritional; Minerals

1. Introduction

In recent times, plants are being extensively explored for possessing medicinal properties. The traditional and folk medicinal system uses plant products for the treatment of various infectious diseases. Studies by various researchers have proved that plants are one of the major sources for drug discovery and development[1]. The curative properties of medicinal plants are due to the presence of various complex chemical substances of different composition which occur as secondary metabolites. Many of the phytochemical bioactive compounds from medicinal plants have shown many pharmacological activities. It is a known fact that consuming foods rich in phytochemicals provides health benefits, but there are gaps of information to make specific recommendations for phytochemical intake[2]. Phytochemicals may display antioxidant, anti-inflammatory, anticancer, antimalarial and antimicrobial properties but are known to function as immuno modulators. The phytochemical analysis of plants is very important so as to give credence or validate the consumption of the plant. For proper development and wellbeing, a good nutrition as a basic need is required [2].

Anti-nutritional factors are substances that when present in food reduce the availability or utilization of one or more nutrients, thereby altering the expected nutritional status of animals[2]. In effect, they play a great role in limiting the

*Corresponding author: KE Essien
Physical Science Faculty, Department of Chemistry, Akwa Ibom State University, Nigeria.

wider use of many plants. They include, oxalate, saponins, alkaloids, tannins, cyanogenic glycosides and phytate.The mechanisms by which anti-nutritional factor exhibit their anti-nutritional effect differ including affecting the digestibility of protein and thus protein bioavailability, complexing with metaloenzymes cofactors and complexing with membrane sterols, resulting in increased permeability of the intestinal mucosa among others.

Traditionally in Nigeria, *S. alternata* is used to promote urination, check and heal hemorrhages, stop dysentery, and treat veneral diseases. In folk medicine, the plant is used to heal wounds, cuts and ulcers. Internally, it is used to cure anaemia, traditionally leaves are used to treat gall stones, excessive menstration and as a contraceptive[2].The main aim of this work was to examine the nutirtional and antinutritional factors of *S.alternate.*

2. Material and methods

2.1. Sample collection

Fresh leaves of *S. alternata* were collected from a local place in Akwa Ibom State. A Botanist, from the University of Uyo, Nigeria, identified and authenticated the plant. The leaves were air dried at room temperature ± 28^{o}C. The dried leaves were reduced to powder using a laboratory blender, and was stored in air tight container prior for extraction [2].

2.2. Determination of Minerals

The sample was ashed and dissolved in hydrochloric acid, then transferred into a volumetric flask, and the volume made up to 50ml using distilled deionized water[3]. The mineral element concentrations, thus; Calcium Ca, Sodium Na, Potassium K and Magnesium Mg were determined using atomic absorption spectrophotometer according to the method outlined by Williams [3]. The method reported by Fiske and Subbarow [4] was used in the determination of Phosphorous [3].

2.3. Anti-nutritional and phytochemical analyses of *S. alternata*

The following methods were used for the analysis:

- Phytate content of the sample was determined according to the method outlined by Lolas and Markakis [5].
- Alkaloid content of samples was determined using the gravimetric method of Harborne [6]
- Tannin content of the sample was determined using methods described by Horwitz and Latimer [7].
- Cyanogenic glycosides were determined using the method described by Horwitz and Latimer [7]
- The oxalate content of powdered sample was determined by the modified method by Horwitz and Latimer [7]
- The saponin content of the sample was determined by double extraction gravimetric method described by Harborne [6]

3. Results and discussion

3.1. Minerals composition

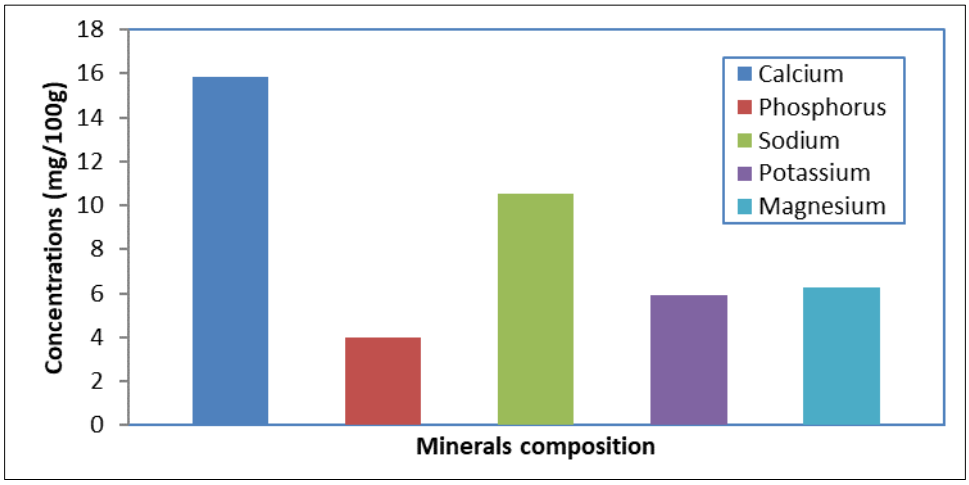

Figure 1 Minerals Composition (mg/100g) of *S. alternata*

Minerals composition was conducted to establish the nutritional value of *S. alternata*. The five minerals evaluated were calcium, sodium, potassium, phosphorus and magnesium.

Figure 1 showed that S. alternata has high content of the following essential minerals; Calcium, and Sodium with the following concentrations; 15.82 ± 0.01mg/100g and 10.55 ± 0.01 mg/100g, respectively. While relative amount of Potassium (5.89 ± 0.03mg/100g), Phosphorus (3.97 ± 0.02mg/100g) and Magnesium (6.29 ± 0.02mg/100g) were also found to be present in the sample. This implies that *Strobilanthes alternata* can be a good supplement for Calcium and Sodium.

3.2. Antinutritional factors of *S. alternata*

The anti-nutritional composition of *S. alternata* is presented in figure 2. Four factors which include, phytates, oxalates, tannins and Cynogenic glyconides were quantitatively determined.

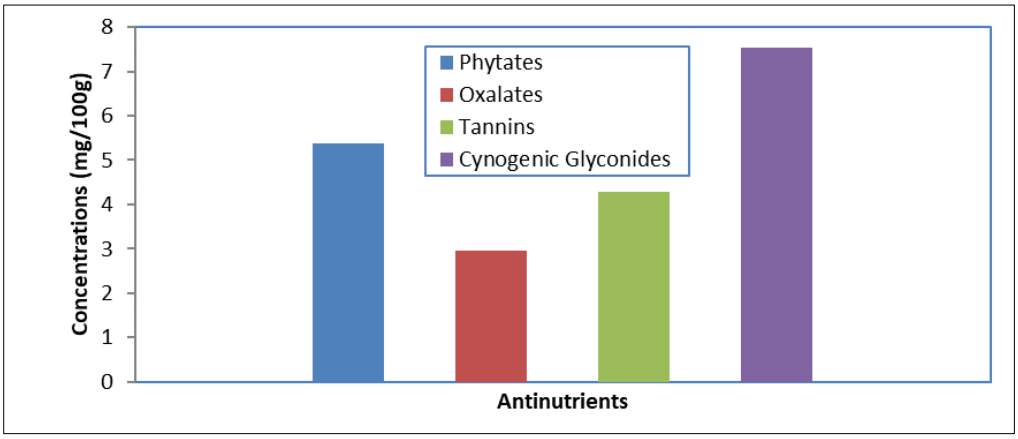

Figure 2 Anti-nutritional Composition of *Strobilanthes alternata*

The concentrations of phytates, oxalates, tannins and Cynogenic glyconides in *S. alternata* are 5.37 mg/100g, 2.95 mg/100g, 4.29 mg/100g and 7.53 mg/100g respectively shown in Figure 2. Cynogenic glyconides has the highest value while oxalate has the least value. High value of oxalate in human diet can increase the risk of renal calcium absorption and has been implicated as a source of kidney stones [8]. Whereas high value of tannin in foods interferes with protein absorption and digestive enzymes[3]. From the results obtained in this study, the concentrations of oxalate, tannin and phytate in *Strobilanthes alternata* leaves are low to cause any health risk in human being [9].

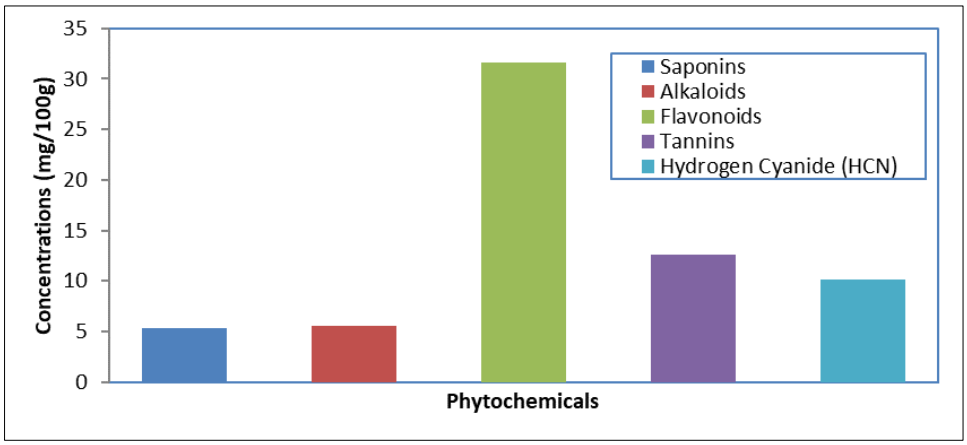

Figure 3 Phytochemical Composition of *S. alternata*

The presence of oxalate in foods or vegetables higher than acceptable levels causes irritation in the mouth and the lining of the gut [10] and also delays the absorption of divalent minerals, particularly calcium [11]. This actually makes calcium hard to find by the body, in particular for maintenance of strong bones, teeth, co-factor in enzymic reactions, nerve impulse transmission and blood clothing [12].

3.3. Phytochemicals composition of *S. alternata*

Phytochemicals in general are known for being liable for protective health benefits in man and animals [13]. The use of *S. alternata* in traditional medical practice for cure or prevention of diseases had been justified by the phytochemicals content found in this analysis [14]. From recent research, Saponins seem to harbour hypocholesterolemic, immunostimulatory and anticarcinogenic properties. They also minimize the risk of heart diseases in humans [10].

However, the concentration of saponins recorded was 5.28 ±0.01 mg/100g. The bitter taste and astringency in dietary plants are caused by high concentrations of Saponins [10]. This bitter taste is believed to be a major factor that limits the use of saponins. More so, saponins possess the ability to reduce the bioavailability of nutrients and decrease enzyme activity [15]. The saponins concentration determined in this work (5.28 ±0.01 mg/100g) is within acceptable levels. At levels less than 10% in a diet is said to be harmless to the body [16].

The alkaloids found in *S. alternata* stands at 5.54 ±0.01 mg/100g. Alkaloids are phytochemicals and sometimes are regarded as antinutrients because of their action on the nervous system, where they disrupt electrochemical transmission when they are consumed in large quantities [10]. Consumption of alkaloids in large amount could be toxic particularly when it exceeds the lethal dose of 20 mg/100g[17]. The quantity of alkaloids (5.54 ±0.01 mg/100g) recorded in this work is much less than the lethal dose of 20 mg/100g. Alkaloids possess various pharmacological activities including antimalarial, antiasthma, anticancer, vasodilatory, antiarrhythmic, analgesic antibacterial and antihyperglycemic activities. They are used in traditional or modern medicine, or as starting points for drug discovery and development.

The concentration of tannins recorded in this work is 12.59 mg/100g, which is much less than lethal dose of tannins (30 mg/100g) reported by [17]. Tannins are recognized to be heat stable and they interfere with the digestion of protein in humans and animals, possibly by making protein partially unavailable or by inhibiting digestive enzymes and increasing fecal nitrogen. Tannins present in food products exhibit the ability to inhibit the activities of trypsin, chemotrypsin, amylase and lipase.

The *S. alternata* showed the level of Flavonoids to be 31.60 ± 0.02mg/100g. Flavonoids also exhibit various pharmacological activities; antimalarial, antiinflammatory, antioxidant [18]. These phytochemicals in *S. alternata* gives the plant a nutritional advantage.

The *S. alternata* showed the level of Hydrogen cyanide to be 10.11 ± 0.01 mg/100g. High level of Hydrogen cyanide, however, has been associated for cerebral damage and lethargy humans and animals [19]. The amount of Hydrogen cyanide(10.11±0.01 mg/100g) recorded in this work is within the permissible level of 5.3 to 80 mg/100g [20].

4. Conclusion

The phytochemicals and minerals determined in *S. alternata gave* a nutritional advantage and validated the use of the leaves in traditional and alternative medicines. The quantities of antinutrients found in this work were above the acceptable levels for human and animal consumption. However, traditional processing techniques should be used to reduce the levels of anti-nutrients to make it safer for drugs development. This study revealed the nutritional and antinutritional content of *S. alternata* which are known to possess the active medicinal chemical constituents.

Compliance with ethical standards

Acknowledgments

The authors wish to express deep appreciation to the Akwa Ibom State University, Mkpat Enin, Nigeria for providing facilities for this study.

Disclosure of conflict of interest

The authors declare no conflicts of interest.

References

[1] Chandra H, Bishnoi P, Yadav A, Patni B, Mishra AP, Nautiyal AR. Antimicrobial resistance and the alternative resources with special emphasis on plant-based antimicrobials—a review. Plants 2017;6:16.

[2] Sha'a KK, Clarkson GP, Artimas SP. Phytochemical analysis, proximate composition and antinutritional factors of Corchorus oliterius plant. Int J Biol Chem Sci 2019;13:2147–57.

[3] Sulaiman A, Anas MS. Quantitative determination of nutritional and anti-nutritional composition of clove (Eugenia caryophllata). Dairy Vet Sci J 2017;3:1–3.

[4] Fiske CH, Subbarow Y. The colorimetric determination of phosphorus. J Biol Chem 1925;66:375–400.

[5] Lolas GM, Markakis P. Phytic acid and other phosphorus compounds of beans (Phaseolus vulgaris L.). J Agric Food Chem 1975;23:13–5.

[6] Harborne JB. Methods of plant analysis. Phytochem. methods, Springer; 1984, p. 1–36.

[7] Horwitz W, Latimer GW. Official methods of analysis of AOAC 18. AOAC Int Gaithersburg, Md 2005.

[8] Chai W, Liebman M. Effect of different cooking methods on vegetable oxalate content. J Agric Food Chem 2005;53:3027–30.

[9] Achinewu SC, Aniena MI, Obomanu FG. Studies on spices of food value in the South eastern states of Nigeria 1: Antioxidants Properties. J African Med Plants 1995;18:135–9.

[10] Gemede HF, Ratta N. Antinutritional factors in plant foods: Potential health benefits and adverse effects. Int J Nutr Food Sci 2014;3:284–9.

[11] Ola FL, Oboh G. Anti-nutritional Factors. Nutr Qual Plant Foods J Technoscience 2000;4:1–3.

[12] Unuofin JO, Otunola GA, Afolayan AJ. Research Article Essential Oil Composition, Nutrient and Anti-nutrient Analysis of Vernonia mespilifolia Less. Res J Bot 2017;12:38–45.

[13] Webb D. Phytochemicals' role in good health. Today's Dietit 2013;15:70.

[14] Sharmila BG, Kumar G, Rajasekara PM. Cholesterol lowering activity of the aqueous fruit extract of Trichosanthes dioica Roxb. in normal and streptozotocin diabetic rats. J Clin Diag Res 2007;1:561–9.

[15] Liener IE. Phytohemagglutinins. Their nutritional significance. J Agric Food Chem 1974;22:17–22.

[16] Igile GO, Iwara IA, Mgbeje BIA, Uboh FE, Ebong PE. Phytochemical, proximate and nutrient composition of Vernonia calvaona Hook (Asterecea): A green-leafy vegetable in Nigeria. J Food Res 2013;2:1.

[17] Inuwa HM, Aina VO, Gabi B, Aimola I, Toyin A. Comparative determination of antinutritional factors in groundnut oil and palm oil. Adv J Food Sci Technol 2011;3:275–9.

[18] Liu RH. Health benefits of fruit and vegetables are from additive and synergistic combinations of phytochemicals. Am J Clin Nutr 2003;78:517S-520S.

[19] Agbaire PO. Levels of anti-nutritional factors in some common leafy edible vegetables of southern Nigeria. African J Food Sci Technol 2012;3:99–101.

[20] Wobeto C, Corrêa AD, Abreu CMP de, Santos CD dos, Pereira HV. Antinutrients in the cassava (Manihot esculenta Crantz) leaf powder at three ages of the plant. Food Sci Technol 2007;27:108–12.