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Proximate composition and nutrient analysis of *Aneilema aequinoctiale* leaves

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ABSTRACT

This work was carried out to determine the proximate composition, mineral elements, vitamins and anti-nutrients of Aneilema aequinoctiale. The results from the proximate analysis indicate that the plant contained some important nutrients such as carbohydrate 46.02 ± 0.01%, lipid 29.68 ± 0.01%, crude protein 17.05 ± 0.01%, crude fibre 1.34 ± 0.02% and had Caloric value of 519.37±0.02 kcal. The mineral element analyzed were Calcium (Ca) 232.90 ± 0.01mg/kg, Iron (Fe) 154.39 ± 0.02mg/kg, Potassium (K) 147.62 ± 0.02mg/kg, Cadmium (Cd) 0.49 ± 0.02mg/ kg and Copper (Cu) 0.68 ± 0.11mg/kg. The anti-nutrient analysis revealed that the plant contained 4.34 ± 0.03 mg/100g hydrocyanic acid, 378.39 ± 0.01mg/100g soluble oxalate and 857 ± 1.4mg/100g total oxalates, while phytate had a value of 0.08±0.02mg/100g. Vitamins analysis showed the presence of vitamin C (ascorbic acid) 0.73 ± 0.04mg/100g, and vitamin A (retinol) 0.32±0.02mg/100g.

Keywords: *Aneilema aequinoctiale,* proximate composition, mineral elements, anti-nutrients and vitamins.

INTRODUCTION

Aneilema aequinoctiale is an herbaceous monocotyledonous plant and is distributed in the tropical and subtropical parts of the world. *Aneilema* is the second largest genus in the family; Commelinaceae with about 100 species out of which 10 are common in the West African sub – region. They are popularly recognized as weeds but some species serve as livestock feed and medicinal plants (Hutchinson and Dalziel, 1968; Burkill, 1985; Akobundu and Agyakwa, 1987). The four commonly found species in West Africa include *A. aequinoctiale* (P. Beaux) Kunth, *A. beniniense* (P. Beaux) Kunth, *A. paludosum* A. Chev and *A. Unbrosum* (Vahl) Kunth.

Proximate and nutrient analyses of edible plant and vegetables play a crucial role in assessing their nutritional significance (Pandey *et al*., 2006). As various medicinal plant species are also used as food along with their medicinal benefits, evaluating their nutritional significance can help to understand the worth of these plant species (Pandey *et al*., 2006). For herbal drug's standardization is concerned, WHO also emphasize on the need and importance of determining proximate and micronutrients composition of the herbal plants. Such herbal formulations must pass through standardization processes (Niranjan and Kanaki, 2008).

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 physiological functions of human body. Such nutrients and biochemicals like carbohydrates, fats and proteins play an important role in satisfying human needs for energy and life processes (Novak and Haslberger, 2000).

Fortunately, chemical composition diversity in plants also includes many compounds that are beneficial to humans: vitamins, nutrients, antioxidants, anticarcinogens, and many other compounds with medicinal value (Novak and Haslberger, 2000).

In the ancient days of human existence, by instinct, intuition, or trial and error, man was able to identify various plants used to combat various ailments. In fact, it is the knowledge derived from the active components of these plant extracts that guided man to synthesize and use modern drugs in health care delivery. Presently, there has been a renewed interest in the study of medicinal plants such that much percentage of pharmaceutical preparations is based on natural products from plants. Over the years, our people have passed down knowledge of the types and applications of medicinal plants from generation to generation, often orally. The compilation of useful drugs derived from medicinal plant is impressive; these include; heart drugs, analgesics, anesthetics, antibiotics, anti-cancer and anti-parasitic compounds, anti-inflammatory drugs, oral contraceptic hormones, as well as laxative diuretics (Morris, 2004).

Plants generally contain chemical compounds (such as saponins, tannins, oxalates, phytates, trypsin inhibitors and cyanogenic glycosides) known as secondary metabolites, which are biologically active (Soetan and Oyewole, 2009). Secondary metabolites may be applied in nutrition and as pharmacologically-active agents (Soetan and Oyewole, 2009). Plants are also known to have high amounts of essential nutrients, vitamins, minerals, fatty acids and fibre (Gafar and Itodo, 2011).

Aneilema aequinoctiale have been used traditional by many people in Akwa Ibom State, Nigeria, for the treatment of cough, but the report on it nutritive and anti-nutritive composition is scanty. Hence the aim of this work is to determine the proximate composition, mineral element, vitamins and anti-nutrient of this plant in order to ascertain it safety or otherwise to man.

MATERIALS AND METHODS

2.1 Collection and Treatment of Sample

The samples were collected and treated by the methods recommended by Trease and Evans (1989) and Williamson *et al.,* (1996). The entire plant comprising, root, steam and leaves, of *Aneilema aequinoctiale* was collected from different forest areas in Nsit Ubium and Uyo Local Government Area in Akwa Ibom State, Nigeria. The plant was identified by the taxonomist in the Faculty of Pharmacy and Department of Botany University of Uyo.

The plant was separated from weeds and dirt, washed and rinsed with distilled water. It was sun-dried for 5 days, ground in a mortar with a pestle into coarse power and packed in an air-tight plastic container for further analysis.

2.2 Proximate Composition

Determination of proximate composition was carried out in accordance with A.O.A.C. methods (1990). Proximate composition of a substance constitutes the different classes of nutrients present in the samples such as carbohydrates, protein, fat, crude fibre, ash and moisture as well as caloric value calculated from values of carbohydrate, fat and protein. All the methods used in estimating the chemical composition of the plant samples were standard methods of the Association of Official Analytical Chemists (1990) except where otherwise stated.

- Moisture content, Ash Content, Crude Protein (AOAC, 1990)
- Crude fibre content (A.O.A.C., 1990).
- Carbohydrate content was estimated by subtracting the values obtained for fat and protein from organic matter. The percentage of organic matter was calculated by subtracting the percentage of ash from one hundred (100) (Onwuka, 2005).
- The caloric value of the sample was calculated using "Atwater factor" by multiplying the value of the crude protein, lipid and carbohydrate by 4, 9, 4 respectively and taking the sum of the product (Onwuka, 2005).

2.3 Estimation of Mineral Element (A.O.A.C., 1990)

Mineral elements estimations indicate the amount of inorganic elements present in the sample. The determination was carried out using standard procedures. During the determination, the sample was first ashed and dissolved in a solvent, and the resultant solution aspirated into an air-acetylene flame. The mineral element determined were; Zinc (Zn), Lead (Pb), Manganese (Mn), Copper (Cu), Potassium (K), Sodium (Na), Iron (Fe), Cadmium (Cd), Phosphorus (P) and Calcium (Ca) and this was done by spectrophotometric methods, using flame emission spectrophotometer for Sodium (Na) and Potassium (K) and atomic absorption spectrophotometer for others. Before determining the concentration of any element in the sample, a calibration curve of the element in the sample, was prepared using prepared standard stock solutions for the elements (Olaniyi, 2000).

Estimation of Vitamins

Vitamin C (Ascorbic Acid)

Ascorbic acid reacts with 2, 4-dinitrophenylhydrazine after oxidation of vitamin C to dehydroascorbic acid. Ascorbic acid is oxidized to dehydroascorbic acid by cupric sulphate. The dehydroascorbic acid in a strong acid solution reacts with 2, 4 dinitrophenylhydrazine to form a dinitrophenylhydrazone. The hydrazine in the presence of strong sulphuric acid solution develops a red colour which can be measured spectrophotomertically. Thiourea was added to dinitrophenylhydrazine reagent to prevent its oxidation by interfering substances.

Vitamin A

18g of antimony trichloride was dissolved in 100ml of chloroform by warming slightly and cooled in ice water until excess of reagent separated. The supernatant was used for the test procedures.

RESULTS AND DISCUSSION

The data obtained in the course of the experiments are shown in the tables below and the discussion of these result are also given.

Proximate Composition

The results of proximate composition of *Aneilema aequinoctiale* is presented in Table 1.

The proximate analysis showed the moisture content of *Aneilema aequinoctiale* to be 84.89±0.08% (w/w). This result indicated low shelf life of the fresh plant hence long storage would lead to spoilage due to its susceptibility to microbial attack. This supports the practice of storage in dry form by users. Moisture content is among the most vital and mostly used measurement in the processing, preservation and storage of food (Onwuka, 2005).

Table 1: Proximate Composition of *Aneilema aequinoctiale*

Parameter	Composition
Moisture content (%)	84.89 ± 0.08
Ash (%)	5. 89± 0.01
Crude Fibre %	1.34 ± 0.02
Crude Lipid (%)	29. 68 ± 0.01
Crude Protein (%)	17.05 ± 0.01
Carbohydrate (%)	46.02 ± 0.01
Caloric value (kcal/100g)	519.37 ± 0.02

Results are mean of triplicate determinations ±SD

Ash content of 5.89±0.01% dry matter (DM) was obtained as a result for *Aneilema aequinoctiale*.. Ash in food contributes the residue remaining after all the moisture has been removed as well as the organic material (fat, protein, carbohydrates, vitamins, organic acid etc) have been incinerated at a temperature of about 500^{o}C. Ash content is generally taken to be a measure of the mineral content of the original food (Onwuka, 2005).

Crude fibre in food or plant is an indication of the level of non-digestible carbohydrate and lignin. The crude fibre obtained for *Aneilema aequinoctiale* was 1.34±0.02% (DM). This low level is considered appropriate, because it aids absorption of glucose and fat. Although crude fibre enhances digestibility, its presence in high level can cause intestinal irritation, lower digestibility and decreased nutrient usage (Oladiji *et al.*, 2005). Crude fibre is made up largely of cellulose together with a little lignin which is indigestible in human (Onwuka, 2005).

The crude lipid content obtained for *Aneilema aequinoctiale* was 29.68±0.01% (D. M). Lipid provides very good sources of energy and aids in transport of fat soluble vitamins, insulates and protects internal tissues and contributes to important cell processes (Jones *et al.*, 1985, Pamela *et al.*, 2005). Moreso, it is good to add lipid (fat) to most of our diets, because many body functions depend on lipids.

The crude protein of *Aneilema aequinoctiale* was 17.05±0.01% (DM). The recommended dietary allowance (RDA) for protein is 56g for individual weighing 70kg and 46g for adult weighing 50kg, children may consume 2kg/day (Jones *et al.*, 2005).

The plant is a moderate source of protein. According to Pamela *et al.*, (2005), proteins from plant sources have lower quality but their combination with many other sources of protein such as animal protein may result in adequate nutritional value.

The carbohydrate content of *Aneilema aequinoctiale* was 46.02±0.01%. The plant is a moderate source of carbohydrate when compared with the Recommended Dietary Allowance (RDA) of 130g (Pamela *et al.*, 2005). The caloric value of *Aneilema aequinoctiale* was 519.37±0.02 kcal/100g. An average person requires 2000-3000 kcal per day (Jones *et al.*, 1985). The plant can contribute to the caloric requirement of the body.

4.3 Anti-Nutrients

Table 2: Anti-nutrients Composition of *Aneilema aequinoctiale*

Anti-nutrient	Level
Hydrocyanide (HCN) (mg/100g)	4.34 ± 0.03
Total oxalates (mg/100g)	857 ± 1.4
Soluble oxalates (mg/100g)	378.39 ± 0.01
Phytate (mg/100g)	0.08 ± 0.02
Tannin (mg/100g)	0.55 ± 0.04

Results are mean of triplicate determinations ±SD

The result of anti-nutrients of *Aneilema aequinoctiale* is presented in Table 2. The level of HCN in *Aneilema aequinoctiale* was 4.34±0.3mg/100g. Hydrogen cycnide is a colourless, very poisonous and highly volatile liquid that boils slightly above room temperature at 26^{o}C (78.8^{o}F). Hydrogen cyanide is weakly acidic and partly ionizes in solution to give the cyanide anions CN^- (Blum *et al.*, 1962). Cyanide (CN^-) concentration of 300 parts per million (ppm) in air will kill a human being within a few minutes. The toxicity is caused by the cyanide ion, which prevent cellular respiration. Blum *et al.,* (1962) reported the lethal dose of hydrocyanic acid for adult man as 50-60mg/kg.

The level of soluble oxalate was 378.39±0.01 mg/100g while the total oxalate was 857±1.4 mg/100g. Dietary oxalate has been known to complex with calcium, magnesium, and iron leading to the formation of insoluble oxalate salts resulting in oxalate stones and interferes with utilization of the minerals. The lethal level in man is 2-5g (Onwuka, 2005).

The phytate (phytic acid) level in the *Aneilema aequinoctiale* was found to be 0.08±0.02 mg/100g. Phytic acid has no known toxicity and is not known to cause mutagenic activity. It may have more therapeutic value when added to water rather than when naturally absorbed in foods as it is difficult to free from fibres. Phytic acid is one of few chelating therapies for uranium removal. Phytic acid has some mineral binding properties. It may prevent colon cancer by reducing oxidative stress in the lumen of the intestinal tract (Dickie *et al.*, 2007).

The tannin content in *Aneilema aequinoctiale* was 0.55±0.04 mg/100g. It is usually found in dead or dying cells of plants and it exert an inhibitory effect on many enzymes due to protein precipitation. It contributes to the protective function in the barks and heartwood of plants (Sofowora, 1982).

Vitamins

Table 3 present the result of vitamin contents in *Aneilema aequinoctiale* in mg/100g (dry matter).

The content of vitamin A (Retinol) in *Aneilema aequinoctiale* was 0.32±0.02 mg/100g. Vitamin A is required by human for normal growth of body cells, skin, and for proper vision. Deficiency of vitamin A can result in night blindness and reduced resistance to diseases.

The content of vitamin C (Ascorbic Acid) was 0.73±0.04 mg/100g. Vitamin C aids wound healing and also help in resisting infection. Its deficiency can cause scurvy (characterized by bleeding gum, poor healing of wound and low resistance to infection. The recommended dietary allowance of vitamin C is 45mg per day (WHO, 1991).

Table 3: Level of Vitamins in *Aneilema aequinoctiale*

Vitamin	Level
Vitamin A (mg/100g)	0.032 ± 0.02
Vitamin C (mg/100g)	0.73 ± 0.04

Results are mean of triplicate determinations ±SD

Mineral Element Composition

Table 4 present the result of mineral element composition of *Aneilema aequinoctiale*, in mg/kg dry matter. The zinc content of *Aneilema aequinoctiale* was 33.23±0.04mg/kg. The Recommended Dietary Allowance (RDA) for zinc is 13mg/kg (Jone *et al.*, 1985). Zinc is essential in the activation of certain enzymes. These include dehydrogenase, alkaline phosphatese and carboxypeptidase. Zinc containing organic compounds is employed as astringent and antifungal agents. It aids wound healing and metabolism of nucleic acid and insulin. Zinc in excess causes anaemia and if deficient in the body can lead to dermatitis.

The value obtained for lead (Pb) was 1.22±0.03 mg/kg. Effect of lead deficiency in the body results in anemia while excess lead (Pb) in the body can cause brain damage (Stoker, 1976). Lead is a natural constituent of soil, water, vegetation, animal life and air, but the levels of the natural concentration are not certain. Significant sources of naturally occurring lead in air would include silicate dust from soils and particles from volcanoes. Man is the leading contributor, however from such sources of manufacturing, use of pesticides, combustion of coal, incineration of refuses, and gasoline. The available data indicate that combustion of lead gasoline is the major source of airborne lead in urban areas (Udoessien, 2003). The maximum permitted level of lead (Pb) in packaged and unpackaged potable water is 0.01 mg/l (SON, 2003).

Table 4: Mineral Element Composition (mg/kg, dry matter) of *Aneilema aequinoctiale*

Minerals	Conc. mg/kg
Zn	33.23 ± 0.04
Pb	1.22 ± 0.03
Mn	40.23 ± 0.03
Cu	0.68 ± 0.11
K	147.62 ± 0.02
Na	62.12 ± 0.02
Fe	154 39± 0.02
Cd	0.49 ± 0.02
P	50.92 ± 0.04
Ca	232.90 ± 0.01

Results are mean of triplicate determinations ±SD

The manganese content of *Aneilema aequinoctiale* was 40.23±0.03mg/kg. The Recommended Dietary Allowance (RDA) for manganese varies between 2mg/kg to 8mg/kg (Jones *et al.*, 1985). Certain trace elements such as copper, iron, and manganese constitute essential part of any balanced diet. Some of them are micronutrient to the plants and if not present in the right proportion may have adverse effect on human and plants.

The content of copper was 0.68±0.11mg/kg. The Recommended Dietary Allowance of copper according to Jones *et al.*, (1985) is 3.5mg. Copper is very vital in diet because it is involved in the proper usage of iron (Fe) and especially for the synthesis of cytochrome oxidase, which contains both iron (Fe) and copper (Cu). Excess copper can lead to jaundice (Wilson's disease) (Stoker, 1974).

The potassium content was 147.62±0.02 mg/kg. According to National Research Council (1974), the Recommended Dietary Allowance of potassium is 1875-5625mg/kg for adults. Potassium is very vital in regulation of water and electrolyte balance and acid-base balance in the body, as well as responsible for nerve action and functioning of the muscles. Deficiency of potassium leads to muscle paralysis (Michael, 2006).

The sodium content was 62.12±0.02mg/kg. Sodium is a very important mineral element that aids the transmission of nerve impulses as well as maintenance of osmotic balance of the cells. According to National Research Council (1974), the Recommended Daily Allowance for sodium is 1100-3300mg/100g for adults. Deficiency of sodium may lead to dehydration or muscle cramp (Michael, 2007).

The iron content of *Aneilema aequinoctiale* was 154.39±0.02 mg/kg. According to Bolt *et al.*, (1978), the recommended daily requirement of iron for man is 6 – 40mg/kg. Iron is very important in the formation of haemoglobin in red blood cells and deficiency of iron leads to anaemia. *Aneilema aequinoctiale* could be used to improve the anaemic condition of a patient.

The cadmium content obtained was 0.49±0.02mg/kg. Cadmium deficiency can cause reduction in growth rate and excess of it can result in hypertension and nephritis (Stoker, 1976). The maximum permitted level of cadmium (Cd) in packaged and unpackaged potable water is 0.003 mg/l (SON, 2003).

Phosphorus level is 50.92±0.04mg/kg. National Research Council (1974) gave the Recommended Dietary Allowance (RDA) for phosphorus as 4000mg. Phosphorus is an essential mineral element, which aid strong development of teeth and bones. It forms part of DNA and RNA as well as assists in respiration. Deficiency of phosphorus can lead to ricket, osteomalacia and tooth decay (Michael, 2006).

The value obtained for calcium was 232.90±0.01mg/kg. Among all the mineral elements analysed, calcium exhibited the highest value. The Recommended Dietary Allowance for calcium is 600-1400mg (Bolt *et al.*, 1978).

Calcium is essential for bone and teeth formation and development, blood clotting and for normal functioning of heart, nervous system and muscles. Calcium deficiency can lead to ricket, osteomalacia and tooth decay (Michael, 2006). Excess calcium may in the soil interfere with phosphorus and boron nutrient and may encourage chlorosis because of reduction of soil manganese, iron and zinc (Brady, 1974).

CONCLUSION

This work was carried out to evaluate the proximate and nutrient composition of *Aneilema aequinoctiale*. The proximate composition analysis showed much about the nutritive value of the plant. The anti-nutrient such as oxalate, hydrocyanide, tannin and phytate of *Aneilema aequinoctiale* can prevent colon cancer by reducing stress in the lumen of intestinal tract.

Vitamin A and C content of *Aneilema aequinoctiale* also contributed in increasing resistance to disease and healing of wound respectively thereby improving normal growth of the body cells, skin and proper vision. However, mineral elements analysed also revealed that *Aneilema aequinoctiale* performed some significant roles in alleviating series of sickness that can result in cough. Hence *Aneilema aequinoctiale* extract which is presently used to treat cough should be encourage since the anti–nutritive and heavy metals composition of the plant is at the acceptable range.

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