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Proximate, Anti-nutrient, Vitamin and Minerals Assessment of *Adenium obesum* (*Forssk.*) Stem Bark

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Abstract: Natural products are now the new substances used to meet up the body's nutrients demand. The purpose of this study was to assess the proximate, anti-nutrient, vitamin and mineral content of *Adenium obesum* (*Forssk*) stem bark. Proximate composition of *A. obesum* stem bark was determined by AOAC procedures. The anti-nutrients determination was carried out using titration method. Vitamin E quantification was determined using spectrophotometric procedure. Mineral contents (Cu, Mg and Zn) were determined using Atomic Absorption spectrophotometer (AAS). The results obtained from the proximate analysis revealed the contents of moisture (4.93%), ash (11.89%), crude fat (4.54%), crude fiber (32.11%) protein (3.94%), carbohydrate (42.59%), organic matter (83.18%) and energy value (226.98 ± 48.55 kcal/100g).Minute amount of anti-nutrient compound phytate0.26% and oxalate 143.09mg/100gwere found to be present in the stem bark. The result of the vitamin and minerals showed the amount of vitamin E (11.4±0.40mg/dl), copper (0.08±0.02mg/L), magnesium (61.33±2.52mg/L) and zinc (0.73±0.10mg/L) in the plant. Therefore, this study revealed that *A. obesum* stem bark contained appreciable amount of nutrients with very low amount of the anti-nutrient compounds which makes it to have more nutritional value.

Keywords: *Adenium obesum*, Proximate, Anti-nutrients, Vitamin E, Minerals

INTRODUCTION

Adenium obesum (*Forssk*) Roem & Schult is an ornamental plant, cultivated worldwide because of its pink "showy" flowers that gives it the name "Desert rose". It is a deciduous pachycaul with half buried swollen base and twisted branches, which may grow up to six meters high. Although the plant can be found worldwide, it is indigenous to the Sahel region of Africa and Central Africa, and the Arabia. The plant is locally called "Kariya" amongst the Hausa ethnic groups of northern Nigeria and called "Akpalataa" amongst the Igbo ethnic groups of south-eastern Nigeria (Samson *et al.* 2014; Lawan *et al*. 2023). Desert rose is widely produced as an ornamental plant due to its attractive flower colors and its swollen stem. The species can also be easily propagated by stem cuttings. Different parts of *A. obesum* plant are utilized in traditional medicines in several countries worldwide for the treatment of a variety of diseases (Suleiman and Brima 2020).

Compounds of the natural origin are in use in both traditional and modern medicine regarding their numerous beneficial effects, which can be used in the prevention and/or therapy of various pathological conditions (Jelena *et al*. 2020).

Nutrition is one of the major modifiable determinants of diseases according to the World Health Organization (WHO) recommendations. Some of the essential nutrients, micronutrients, minerals, and trace elements, as well as nutritional supplements, beside their primary role for adequate functioning of an organism, they possess antioxidant effects through which they can have influence on so many diseases (Jelena *et al*. 2020). Apart from contributing biochemical and energy requirement, plants also act as supplementary sources of vitamins and minerals which are necessary for the body to maintain its physiological homeostasis properly (Datta *et al*. 2019).

Thus, this study was aimed at evaluating the proximate, anti-nutrient, vitamin and minerals composition of the *A. obesum* stem bark.

MATERIALS AND METHODS

Collection and Identification of Plant Material

A. obesum stem bark was collected from the open fields of Dala Girls Secondary School, Dala LGA, Kano State, Nigeria. The plant was identified in the Herbarium Section of the Department of Plant Biology, Bayero University Kano, Nigeria, and the sample was given Herbarium Accession Number BUKHAN 504. The plant sample was shade-dried at room temperature (29 – 31°C) for 3-4 weeks under shade. The stem was ground into fine powder using pestle and mortar and stored in an airtight container before analysis.

Proximate Composition of *Adenium obesum* Stem Bark

Moisture, Ash, Crude Fiber and Crude Protein contents were determined using the method of AOAC (2000) procedure; Crude Fat was estimated as described by the method of AOAC (1990) method; Carbohydrate content was determined using the method described by Ibitoye (2005); And the Energy content was determined following the method of Datta *et al*. (2019).

The Organic Matter content was estimated by subtracting the percentages of moisture and ash content from one hundred.

% Organic matter = 100 – (%Moisture + %Ash)

Data Analysis

The analyses were done in triplicates and all the results were expressed as Mean ± Standard Deviation (SD). The data were analyzed using InStat, version 3.05 Software.

(Sultana 2020)

Anti-Nutrient Content of *A. obesum* Stem Bark

Phytate and Oxalate were determined according to the method described by Emmanuel and Sani (2018).

Vitamin and Mineral Analyses of *Adenium obesum* Stem Bark Powder

Determination of Vitamin E

Vitamin E was estimated as described in the method of Rutkowski *et al*. 2005.

Mineral Analysis

0.5 gram of *Adenium obesum* stem bark was treated with 5ml of concentrated nitric acid HNO_3, the solution was heated on electric hot plate 80ºC - 100ºC. After heating for one hour, the content was treated with additional 5ml of nitric acid (HNO_3) followed by the addition of 2ml 30% hydrogen peroxide and the solution was heated again until the volume of the content was reduced to semi dried. Thereafter, another 5ml of 2N HNO_3 heated 2 minutes, the content was cooled and diluted with 2N HNO_3 and the solution was finally filtered through Whatman filter paper into a volumetric flask and made up to volume of 25ml deionized water. The sample prepared was used for the determination of copper (Cu), magnesium (Mg) and zinc (Zn) in the *Adenium obesum* stem bark and the solution was read directly on Atomic Absorption spectrophotometer (AAS) (Model PerkinElmer PinAAcle 900H) (Aslam *et al*. 2005).

RESULTS AND DISCUSSION

Table 1 shows the result of proximate, anti-nutrients (phytate and oxalate), vitamin E and minerals (Cu, Mg and Zn) composition of *A. obesum* stem bark powder. The quantitative proximate composition revealed the amount of moisture 4.93%; ash 11.89%; crude fat 4.54%; crude fiber 32.11%; crude protein 3.94%; carbohydrate 42.59%; organic matter 83.18% and energy value 226.98%. The anti-

nutrient composition of *A. obesum* stem bark powder showed minimum amount of phytate and oxalate were present in the sample 0.26% and 143.09mg/100g respectively. The vitamin E and mineral analysis of *A. obesum* stem bark powder showed that the plant contained vitamin E, copper, magnesium and zinc and at the values of 11.4mg/dl, 0.08mg/L, 61.33mg/L and 0.73mg/L respectively.

The result of proximate composition showed appreciable amounts of moisture, ash, crude fat, crude fiber, protein, carbohydrate and energy content in *A. obesum* stem bark powder (Table 1).

Table1: Proximate, Anti-nutrient, Vitamin and Minerals Composition of *Adenium obesum* Stem Bark

Parameters	Composition
Moisture (%)	4.93 ± 0.90
Ash (%)	11.89 ± 0.69
Crude Fat (%)	4.54 ± 1.56
Crude Fiber (%)	32.11 ± 4.22
Crude Protein (%)	3.94 ± 0.82
Carbohydrate (%)	42.59 ± 8.08
Organic matter (%)	83.18 ± 1.58
Energy (kcal/100g)	226.98 ±48.55
Phytate (%)	0.26 ± 0.08
Oxalate (mg/100g)	143.09 ± 5.56
Vitamin E (mg/dl)	11.4 ± 0.40
Copper (mg/L)	0.08 ± 0.02
Magnesium (mg/L)	61.33 ± 2.52
Zinc (mg/L)	0.73 ± 0.10

Each value in the table was obtained by calculating the average of three experiments and data are presented as Mean ± Standard Deviation (SD), n=3

Moisture content is the amount of water in a material. Water is an essential component of many foods. 20% of the total water consumption is through food moisture. When foods are eaten, the body absorbed the water content in them. High moisture contents reveal that there must be care for appropriate preservation as they are more liable to microbial degradation and would also exhibit a greater activity of water-soluble enzymes. The moisture content is mostly dependent on humidity, temperature and harvest time of the species (Dattaa *et al.* 2019). High moisture contents tend to promote microbial contamination and chemical degradation. Thus, the moisture contents of natural products enhance their stability (Habibu *et al.* 2016). *A. obesum* stem bark under investigation had very low moisture content level 4.93%.

The ash content is generally recognized as a measure of quality for the assessment of the functional properties of foods (Habibu *et al.* 2016). High ash content in a leafy vegetable would suggests high mineral content, which serves as a measure for improved nutritional quality (Aletan and Kwazo 2019). *A. obesum* contains considerable level of total ash content (11.89%) and this, in turn, may indicate the considerate amount of minerals as seen in the mineral profile of the stem bark. Carbohydrate consumption provides the body with fuel and energy that is required for daily activities and exercise. Adequate carbohydrate is also required for optimum function of the brain, heart, nervous, digestive and immune system while carbohydrate deficiency causes depletion of body tissue (Aletan and Kwazo 2019).

Plants obtain nutrients from two natural sources: organic matter and minerals. Organic matter includes any plant material that returns to the soil and goes through the decomposition process, providing nutrients to the soil (Bot and Benites 2005). The main benefit of organic matter is that it increases the cation exchange capacity, thereby reducing the loss by leaching of elements such as calcium, magnesium and potassium (Nagase and Dunette 2011). High amount of organic matter content was found in the *A. obesum* stem bark (83.18%). This is in line with the proximate analysis of Akpovona *et al.* 2016.

The result of anti-nutrient content of *A. obesum*

showed minimal amount of anti-nutrient (phytate and oxalate) (Table 1). These anti-nutrients interfere with metabolic processes such as growth and bioavailability of nutrients. The mechanism through which anti-nutrient functions is the same (Gemene and Ratta 2014). Presence of phytate has a negative effect on the bioavailability of divalent and trivalent mineral ions such as Zn^{2+}, $Fe^{2+/3+}$, Ca^{2+}, Mg^{2+}, Mn^{2+} and Cu^{2+}, to form poorly soluble compounds that are not easily absorbed from the gastrointestinal tract thus reducing their bioavailability (Gemene and Ratta, 2014; Emmanuel and Sani 2018). Oxalate usually affects calcium and magnesium metabolism and as well react with proteins to form complexes which have an inhibitory effect in peptic digestion (Aletan and Kwazo 2019). Anti-nutritional factors play a vital role in determining the use of plants for humans and animals because they reduce nutrient utilization (Emmanuel and Sani 2018). This is similar to the work of Gul *et al*. 2023 which also found the phytate and oxalate levels to be low in stem bark.

The results of vitamin and mineral analysis of *A.obesum* stem bark showed that the plant contained vitamin E, copper, magnesium and zinc (Table 1).This is in accordance with the work of Adeleye *et al*. 2018 and Gbekele-Oluwa 2013. Information about nutrition is increasingly of concern for many reasons i.e, to meet nutritional requirements or to prevent nutritional deficiency diseases (Ganogpichayagrai and Suksaard 2020).

Plant vitamin E acts as the first line of defence against lipid peroxidation, thereby protecting the cell membranes from free radical attack. Vitamin E increases the orderliness of the membrane lipid packaging, hence allowing tighter packing of the membrane and greater stability to the cell (Rizvi *et al.* 2014). This occurs because the membrane phospholipids are prominent targets of oxidants and vitamin E efficiently prevents lipid peroxidation and promotes membrane repair by preventing the formation of oxidised phospholipids that theoretically might interfere with the membrane fusion events (Rizvi *et al.* 2014). Dietary mineral elements are crucial for good and balanced human nutrition (Adegbaju *et al.* 2019). Minerals are required for normal growth and nerve transmission (Ogbe and Affiku 2011). Deficiency of these nutrients and minerals are known to affect health (Ogbe and Affiku 2011). Copper is found to be an integral part of antioxidant enzymes and it's deficiency has been found to be a risk factor for causing so many diseases (Babaali *et al.* 2020). Magnesium is required for biochemical reactions such as nerve functions. It is also responsible for the formation of protein and nerve transmission in the body (Adegbaju *et al.* 2019). Zinc is another important micronutrient (Adegbaju *et al.* 2019). Zinc is useful for protein synthesis, normal body development and recovery from illness (Ogbe and Affiku 2011). Zinc deficiency is also associated with oxidative stress (Babaali *et al.* 2020).

CONCLUSION

The findings from this study have shown that *A. obesum* stem bark is an important source of nutrient, and the plant has higher nutrient absorption capacity which enhances its medicinal properties when used as a supplement.

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