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## Comparative Macro and Micro-Nutrient Composition of *Eremomastax polysperma* (Benth.) Dandy. and *Aspilia africana* (Pers.) C. D. Adams. Found in Akwa Ibom State, Nigeria

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### Abstract

This study was carried out to investigate bioactive constituents and nutraceuticals of *Eremomastax polysperma* and *Aspilia africana* found in Akwa Ibom State, Nigeria. The plants were collected from in the Department of Botany and Ecological Studies University of Uyo Botanical Garden. Qualitative and quantitative phytochemical screening, proximate, minerals and vitamin analysis were carried out on the plants. Results revealed *Eremomastax polysperma* contained alkaloids, tannins, saponins, terpenes, flavonoids, anthraquinones and cardiac glycosides while extracts of *Aspilia africana* revealed tannins, saponins, terpenes, flavonoids, anthraquinones and cardiac glycosides. Proximate analysis expressed  $81.48 \pm 0.41\%$  of Moisture content,  $2.01 \pm 0.05\%$  of ash,  $1.35 \pm 0.05\%$  of crude fibre,  $3.92 \pm 0.02\%$  of crude protein,  $0.62 \pm 0.01\%$  of crude fat and  $12.83 \pm 0.09\%$  of carbohydrate in the leaves of *Eremomastax polysperma*. Similarly, *Aspilia africana* the values were  $51.17 \pm 0.08\%$  of moisture content,  $6.04 \pm 0.04\%$  of ash,  $12.13 \pm 0.11\%$  of crude fibre,  $7.80 \pm 0.08\%$  of crude protein,  $3.59 \pm 0.14\%$  of crude fat and  $76.74 \pm 0.44\%$  of carbohydrate. Vitamins analysis observed in the leaves of *Eremomastax polysperma* showed  $313.45 \pm 2.25$  mg/100g of vitamin A,  $0.76 \pm 0.10$  % of vitamin B<sub>1</sub>,  $2.29 \pm 0.01$  % of vitamin B<sub>12</sub> and  $264.70 \pm 0.35$  mg/100g of vitamin C. Also,  $0.29 \pm 0.01$  mg/100g of vitamin A,  $2.34 \pm 0.03$  % of vitamin B<sub>1</sub>,  $1.76 \pm 0.01$  % of vitamin B<sub>12</sub> and  $14.67 \pm 2.35$  mg/100g of vitamin C were observed in the leaves of *Aspilia africana*. The mineral composition of the leaves were  $224.31 \pm 1.73$  mg/kg of potassium,  $268.91 \pm 4.06$  mg/kg of calcium,  $191.75 \pm 1.36$  mg/kg of phosphorus,  $4.11 \pm 0.51$  mg/kg of iron,  $158.16 \pm 0.97$  mg/kg of magnesium and  $2.48 \pm 0.27$  mg/kg of zinc. Also, leaves of *Aspilia africana* recorded  $56.35 \pm 0.77$  mg/kg of potassium,  $245.12 \pm 5.84$  mg/kg of calcium,  $25.49 \pm 1.08$  mg/kg of phosphorus,  $2.53 \pm 0.12$  mg/kg of iron,  $85.50 \pm 1.54$  mg/kg of magnesium and  $35.81 \pm 0.68$  mg/kg of zinc. The results from this study revealed that the leaves *Eremomastax polysperma* and *Aspilia africana* contain appreciable phytochemical constituents, proximate composition, mineral components and vitamins. Therefore, the efficacy and efficiency of leaves of *Eremomastax polysperma* and *Aspilia africana* is recommended therapeutically, locally, traditionally and pharmaceutically.

## 1. Introduction

Medicinal plants are the richest bio-resource for drugs in traditional systems of medicine, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates and chemical entities for synthetic drugs [1]. The practice of traditional medicine using medicinal plants is as old as the origin of man and such a practice has been described as herbalism or botanical medicine [2]. Plants are potent 'biochemists' and have been components of phytomedicine since times immemorial; man is able to obtain from them a wondrous assortment of industrial chemicals. Plant based natural constituents can be derived from any part of the plant like bark, leaves, flowers, roots, fruits, seeds, etc i.e. any part of the plant may contain active components [3]. The World Health Organization [4] estimates that 80 percent of the population of some Asian and African countries presently use herbal medicine for some aspect of primary health care. The annual global export value of pharmaceutical plants in 2011 accounted for over US\$2.2 billion [4]. Among the 120 active compounds currently isolated from the higher plants and widely used in modern medicine today, 80% show a positive correlation between their modern therapeutic use and the traditional use of the plants from which they are derived. More than two thirds of the world's plant species, at least 35,000 of which are estimated to have medicinal value, come from developing countries. Some of these compounds are saponins, tannins, essential oils, flavonoids, alkaloids and other chemical compounds which have curative properties [5], [6]. These complex chemical substances of different compositions are found as secondary plant metabolites in one or more of these plants.

*Eremomastax polysperma* belongs to the Family Acanthaceae. *Eremomastax polysperma* is an erect or somewhat scrambling perennial herb, 1.3–2 cm tall; stems glabrous to sericeous-puberulent when young. In Nigeria, the plant is commonly known as a blood tonic plant: Akwa Ibom people (Ibibio) identify it as *edemididuot* meaning purple bark, Yoruba as *Oyun*, Hausa as *Esinyin*, and Igbo as *Akwukwo* [7]. Generally, the plant is used as an analgesic, as well as for the treatment of cutaneous and subcutaneous parasitic infections (venomous stings and bites). Indeed, the plant is an invasive species after a mere few years in an area [8]. Oral administration of *Eremomastax polysperma* leaf mixed with egg helps in the treatment of anaemia and internal heat especially in pregnant women [9]. It is also used to treat penfigures in children [10].

*Aspilia africana* is a member of the Asteraceae family. It is a perennial herb 25–130 cm high, erect; stem scabrid. Leaves lanceolate, 4–12 cm long, 0.7–4–5 cm wide, base cuneate, margins serrate, apex attenuate to acuminate, scabrid on both surfaces and often also pubescent beneath; 3-veined from base; petiole 2–4 cm long, winged. *Aspilia africana* is native to Africa, Madagascar, and Latin America. It is commonly known as wild marigold or haemorrhage plant, originated

from tropical West Africa occurring throughout the region on wasteland of the savannah forested zones and widely distributed across tropical Africa with at least four varieties recognised at altitude range of 800–2100 m [11]. Extracts of leaves of *Aspilia africana* have good potential for use in wound care and wound management [12]. Anti-anaemic potential studies show that *Aspilia africana* could be used in the treatment of anaemia in rabbits when fed as forage [13]. *A. africana* enhanced gastro protection via reduction of acid output, neutrophil infiltration and oxidative stress as reported [14]. Thus, this research evaluates the bioactive constituents in *Eremomastax polysperma* and *Aspilia africana* leaves.



Figure 1. Leaves of *Eremomastax polysperma* (Benth.) Dandy.



Figure 2. Leaves of *Aspilia africana* (Pers.) C. D. Adams.

## 2. Materials and Methods

### 2.1. Plants Collection and Authentication

The leaves of *Eremomastax polysperma* and *Aspilia africana* were collected from plants growing in the Department of Botany and Ecological Studies, University of Uyo Botanical Garden, Akwa Ibom State, Nigeria. The plant samples used for this research work were authenticated by a Plant Taxonomist in the Department of Botany and

Ecological Studies, University of Uyo, Nigeria.

## 2.2. Preparation of Plant Extracts

The fresh leaves of *E. polysperma* and *A. africana* were air dried for 7 days and coarse powdered, 400g each was extracted using 6000ml of 70% ethanol and shaken intermittently for 72 hours. It was filtered and the filtrate concentrated oven dried at 40°C in a water bath. The extract was weighed and stored in 150ml beaker, labeled and covered with foil paper and preserved in the refrigerator at 4°C for use in analysis.

## 2.3. Qualitative Phytochemical Screening

The methods of [6], [15], [16] were used for qualitative phytochemical screening of the leaf extracts. These included tests for saponins, tannins, flavonoids, anthraquinone, terpenes, phlobatannins, alkaloids and cardiac glycosides.

## 2.4. Quantitative Phytochemical Estimation

The quantitative phytochemical compositions of the leaves extract were determined using the methods described by [5], [17]. These include tests for saponins, tannins, flavonoids, alkaloids and cardiac glycosides.

## 2.5. Proximate Analysis

The recommended methods of the [18], [19] were used for the determination of moisture content, crude protein, crude fat, carbohydrate, crude fibre and ash.

## 2.6. Vitamin Analysis

Vitamins such as b-carotene (vitamin A), thiamine (vitamin B<sub>1</sub>), riboflavin (vitamin B<sub>12</sub>) and ascorbic acid (vitamin C) were quantitatively assessed using titrimetric and colorimetric methods as described by [18], [20].

## 2.7. Mineral Analysis

Plant mineral determination was carried out using the methods of [18], [19].

## 2.8. Statistical Analysis

Each experiment was repeated three times. The results are presented with their means±standard error of mean (SEM).

## 3. Results

### 3.1. Qualitative and Quantitative Phytochemical Screening

Qualitative phytochemical screening of ethanolic leaf extracts of *Eremomastax polysperma* and *Aspilia africana* revealed a number of bioactive constituents (Table 1). Ethanolic leaf extracts of *Eremomastax polysperma* revealed alkaloids and saponins were present in abundance. Flavonoids and cardiac glycosides were moderately detected. Tannins, terpenes and anthraquinones in trace amount. While extracts of *Aspilia africana* revealed tannins, saponins, anthraquinones and cardiac glycosides were moderately detected. Terpenes and flavonoids had trace presence (Table 1).

Table 1. Qualitative phytochemical screening of *Eremomastax polysperma* and *Aspilia africana* leaves.

Constituent	Test	Observation	<i>E. polysperma</i>	<i>A. Aspilia</i>
Alkaloids	Dragendoff's	formation of red precipitate indicated the presence of alkaloids.	+++	-
Tannins	Ferric Chloride	a blue-green precipitation	+	++
Saponins	Frothing	formation of 1 cm layer of foam was observed.	+++	++
Terpenes	Libermanns Burchards	formation of brown ring at the junction indicated the presence of phytosterols	+	+
Flavonoids	Shinoda	a red colour indicated the presence of flavonoids	++	+
Phlobatannins		no visible colour	-	-
Free Anthraquinone	Borntrager's	the presence of a pink in the ammoniacal (lower) phase	+	+
Combined Anthraquinone	Sulphuric acid	violet coloration in the ammonia phase (lower layer)	+	++
Cardiac Glycosides	Salkowski Keller-kellani	a reddish-brown colour at the interface brown ring obtained at the interface	++ ++	++ ++

+ Tracely Detected, ++ moderately detected, +++ abundantly detected, - Not detected

Results of the quantitative phytochemical screening constituents in the leaves of *Eremomastax polysperma* and *Aspilia africana* is shown in Table 2. In *Eremomastaxpolysperma*, Alkaloids had the highest content (8.33±0.73%), saponins (4.28±0.01%) while cardiac glycosides recorded the least value (1.39±0.02%). Highest value in *Aspilia africana* was recorded by tannins (6.94±0.07%), saponins (2.27±0.01%) while alkaloids was not detected (Table 2).

Table 2. Quantitative phytochemical screening of *Eremomastax polysperma* and *Aspilia africana* leaves.

Constituents	<i>E. polysperma</i> (%)	<i>A. africana</i> (%)
Alkaloids	8.33±0.73	0
Tannins	3.97±0.04	6.94±0.07
Saponins	4.28±0.01	2.27±0.01
Cardiac glycosides	1.39±0.02	0.70±0.01
Flavonoids	3.61±0.01	2.10±0.01

### 3.2. Proximate Composition of *Eremomastax polysperma* and *Aspilia africana*

The values for proximate analysis expressed in mean( $\pm$ SEM) were  $81.48 \pm 0.41\%$  of Moisture content,  $2.01 \pm 0.05\%$  of ash,  $1.35 \pm 0.05\%$  of crude fibre,  $3.92 \pm 0.02\%$  of crude protein,  $0.62 \pm 0.01\%$  of crude fat and

$12.83 \pm 0.09\%$  of carbohydrate in the leaves of *Eremomastax polysperma* (Figure 3). Similarly, in *Aspilia africana* the values were  $51.17 \pm 0.08\%$  of moisture content,  $6.04 \pm 0.04\%$  of ash,  $12.13 \pm 0.11\%$  of crude fibre,  $7.80 \pm 0.08\%$  of crude protein,  $3.59 \pm 0.14\%$  of crude fat and  $76.74 \pm 0.44\%$  of carbohydrate (Figure 4).

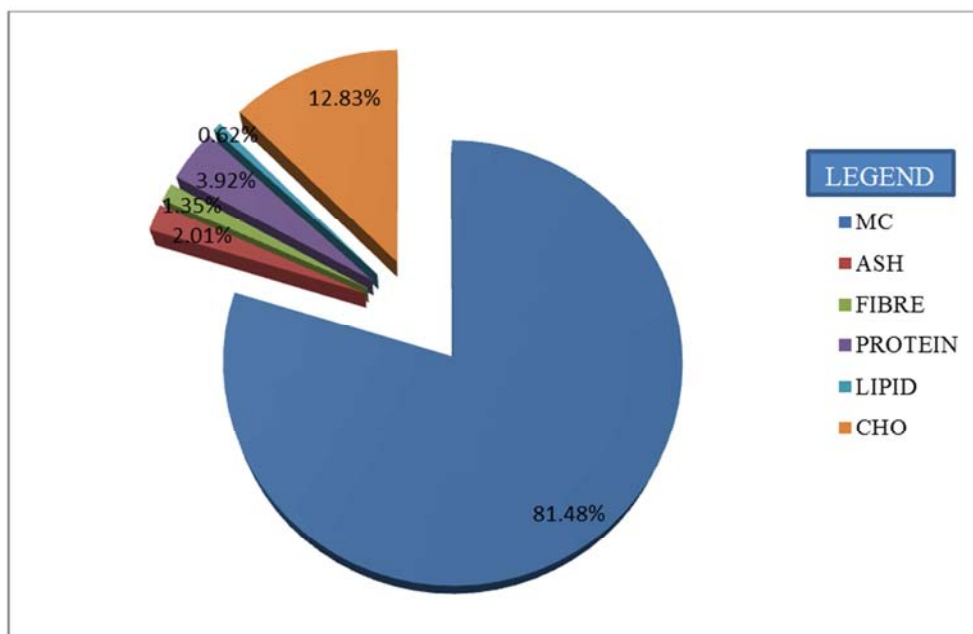


Figure 3. Proximate composition of *Eremomastax polysperma* leaf.

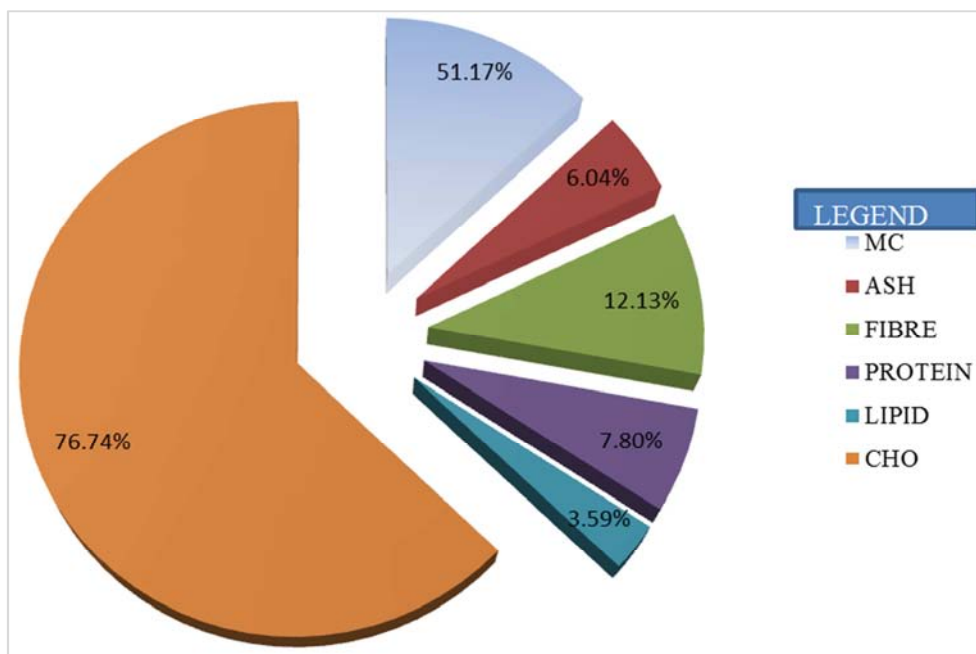


Figure 4. Proximate composition of *Aspilia africana* leaf.

### 3.3. Vitamin Content of *Eremomastax polysperma* and *Aspilia africana*

The vitamins results obtained in the leaves of *Eremomastax polysperma* as shown in Figure 5 are  $313.45 \pm 2.25$  mg/100g of vitamin A,  $0.76 \pm 0.10\%$  of vitamin

$B_1$ ,  $2.29 \pm 0.01\%$  of vitamin  $B_{12}$  and  $264.70 \pm 0.35$  mg/100g of vitamin C. Also,  $0.29 \pm 0.01$  mg/100g of vitamin A,  $2.34 \pm 0.03\%$  of vitamin  $B_1$ ,  $1.76 \pm 0.01\%$  of vitamin  $B_{12}$  and  $14.67 \pm 2.35$  mg/100g of vitamin C were observed in the leaves of *Aspilia africana* as pictured in Figure 6.

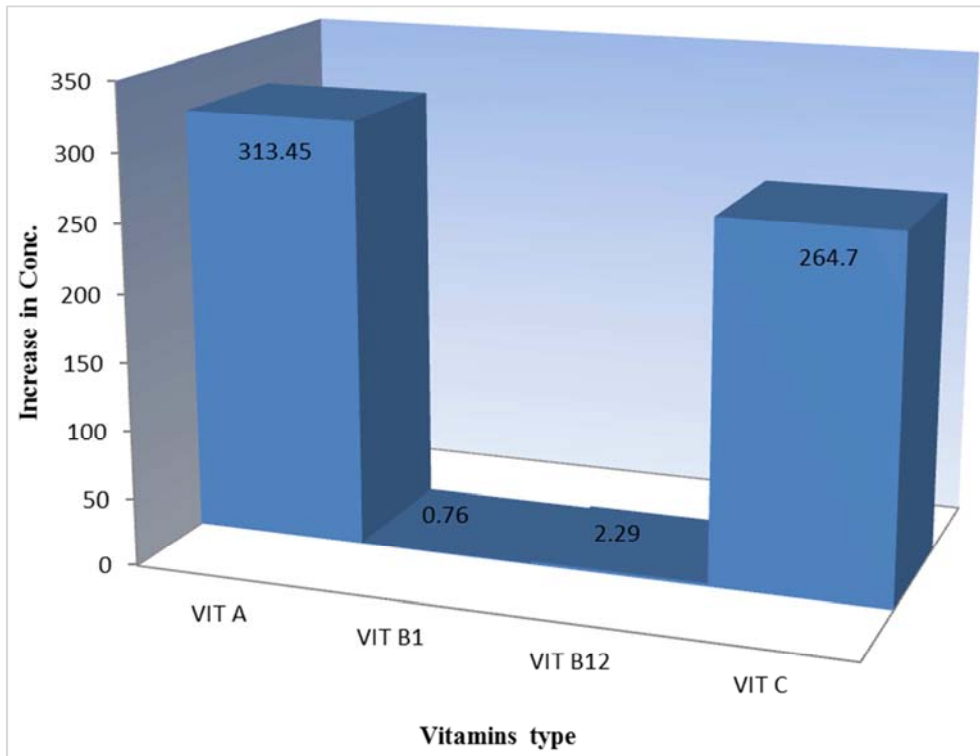


Figure 5. Vitamin content of *Eremomastax polysperma* leaf.

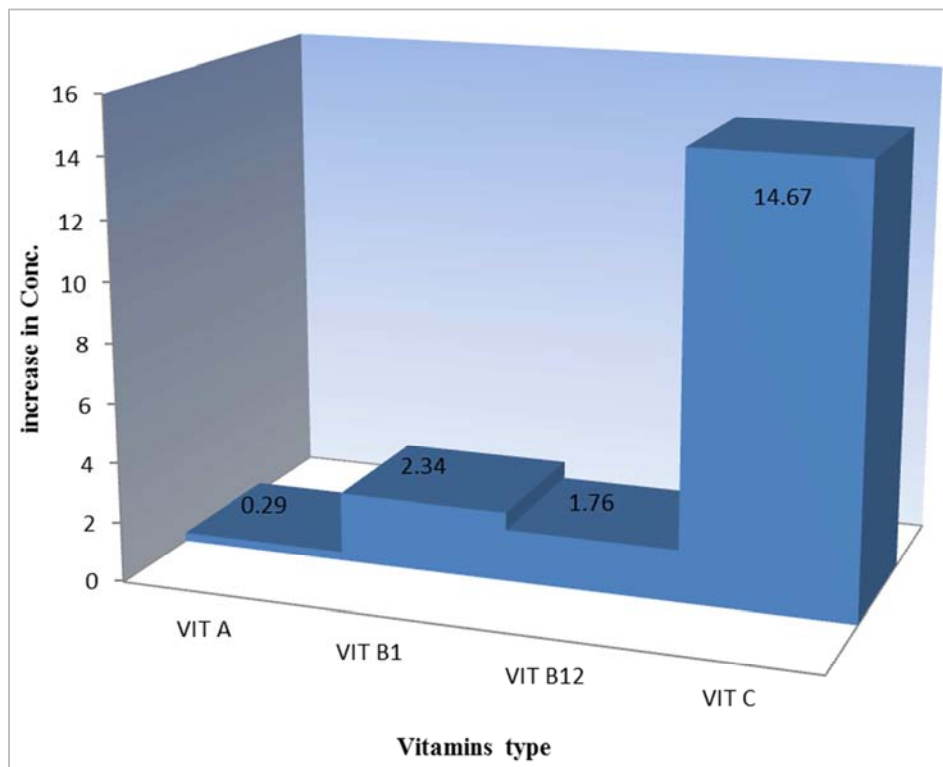


Figure 6. Vitamin content of *Aspilia africana* leaf.

### 3.4. Mineral Composition of *Eremomastax polysperma* and *Aspilia africana*

The mineral composition of the leaves were  $224.31 \pm 1.73$

mg/kg of potassium,  $268.91 \pm 4.06$  mg/kg of calcium,  $191.75 \pm 1.36$  mg/kg of phosphorus,  $4.11 \pm 0.51$  mg/kg of iron,  $158.16 \pm 0.97$  mg/kg of magnesium and  $2.48 \pm 0.27$  mg/kg of zinc (figure 7). Also,  $56.35 \pm 0.77$  mg/kg of potassium,

245.12 ± 5.84 mg/kg of calcium, 25.49 ± 1.08 mg/kg of phosphorus, 2.53 ± 0.12 mg/kg of iron, 85.50 ± 1.54 mg/kg of magnesium and 35.81 ± 0.68 mg/kg of zinc in the leaves of *Aspilia africana* (figure 8).

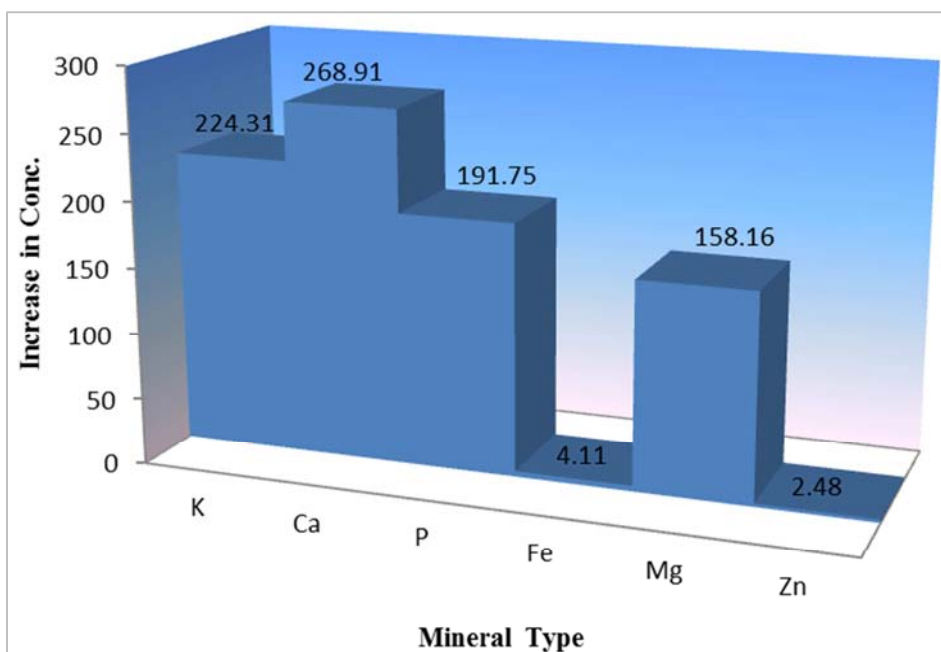


Figure 7. Mineral composition of *Eremomastax polysperma* leaf.

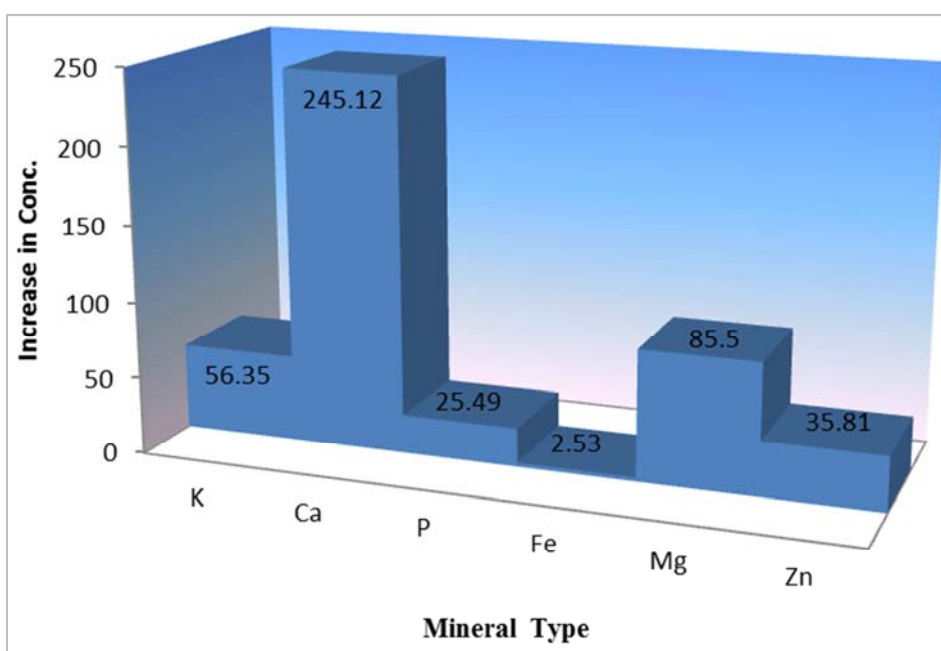


Figure 8. Mineral composition of *Aspilia africana* leaf.

## 4. Discussion

The phytochemical screening qualitative and quantitative estimation of the crude yields of chemical constituents of the plants revealed that the leaf of *Eremomastax polysperma* is rich in alkaloids, flavonoids, tannin, saponins, cardiac glycoside and anthraquinone. However, alkaloids were not present in *Aspilia africana* while other constituents were present. The absence of alkaloids in *Aspilia africana* is in

contradiction with the work of [21] who expressed the prominence of this constituent in Umudike, Abia State while [22] reported the absence of alkaloids in Uyo Akwa Ibom State in correlation with this present study. This suggests that geographical location has a great influence in bioactive constituents present in plants. Alkaloids showed prevalence in *Eremomastax polysperma* and in *Aspilia africana* tannins showed dominance. The presence of phytochemicals in these plant species infers a possibility of medicinal efficiency of these plants. Phytochemicals are non-nutritive chemicals that

contain protective, disease preventive compound. They are naturally occurring compounds in fruits, vegetables, legumes and grains. These compounds are associated with prevention and treatment of diseases such as cancer, cardiovascular diseases and hypertension [23], [24]. The results of qualitative and quantitative analyses clearly indicated pronounced presence of tannins, alkaloids, saponins, cardiac glycosides and flavonoids. Tannins have been reported to provide protection against microbial degradation of dietary proteins [25].

Generally, proximate analysis revealed that the leaves of these plants possessed nutritive content hence their consumption is encouraged. Proximate composition is a key determinant of the edibility or otherwise of any plant species. The constituents of *Eremomastax polysperma* investigated had moisture content, ash, crude fibre, crude protein, crude lipid and carbohydrate. *Aspilia africana* also showed appreciable moisture content, ash, crude fibre, crude protein, crude lipid and carbohydrate. Both species had reasonable proximate contents and are in line with values reported by [26] for *E. polysperma*. Moisture content in plants can affect the concentration of the secondary metabolites as well as the storage quality of such materials [27]. The presence of high levels of carbohydrate in this research is of great significance meeting the energy needs of the person's physical and mental activities, this fact is corroborated by [27]. Fibre is very important for gastro-intestinal tract function as well as preventing and managing a variety of diseases [28].

The vitamin content of *Eremomastax polysperma* and *Aspilia africana* leaves revealed the presence of vitamin A, vitamin B<sub>1</sub>, vitamin B<sub>12</sub> and vitamin C, as also reported by [21]. High vitamins in *E. polysperma* reported in this work further corroborate the report of [26], [29]. Vitamin A has been found to inhibit free radicals and their damaging effects which have been associated with arthritis, heart disease and the development and progression of malignant cells (cancer) [30]. Vitamin C has also been shown to be important for cardiovascular health, reducing free radical production and free radical damage, and good cognitive health and performance [31].

The mineral composition of *Eremomastax polysperma* and *Aspilia africana* leaves expressed potassium, calcium, phosphorus, magnesium, iron and zinc. Calcium, in conjunction with phospholipids, plays a key role in the regulation of the permeability of cell membranes [32]. Potassium and Magnesium regulates intracellular osmotic pressure and acid-base balance. It has a stimulating effect on muscle irritability and the metabolic breakdown of glucose [33], [34].

## 5. Conclusion

The results from this study revealed that the leaves *Eremomastax polysperma* and *Aspilia africana* contain appreciable phytochemical constituents, proximate composition, mineral components and vitamins. Therefore, the efficacy and efficiency of leaves of *Eremomastax*

*polysperma* and *Aspilia africana* is recommended therapeutically, locally, traditionally and pharmaceutically.

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