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Comparative Nutritional Compositions of the Leaves, Bark and Root of *Nauclea latifolia*

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ABSTRACT

This study investigates the nutritional composition of 50% ethanol: water extract obtained from the leaves, stem bark and root of *Nauclea latifolia*. The extracts were assessed for their proximate and mineral contents. The highest level of moisture, fat, protein, ash, crude fibre and carbohydrates were found in the root (12.48), leaves (4.72%), leaves (8.65%), leaves (6.75%), bark (13.35%) and bark (63.90%), respectively. Similarly, the mineral composition results showed that the bark was very rich in Fe and Zn; the leaf contained an appreciable level of Mn, while the root was very high in Ca, K, and Na. All the three plant parts contained low levels of Cu, while Cr was detected in a trace level only in the root. The present study showed that *N.latifolia* is rich in essential nutrients and its usage as food supplement for man and animal should be encouraged.

Key words: *Nauclea latifolia*, Nutrients, Leaves, Bark, Root and Ethnomedicine.

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INTRODUUCTION

Nauclea latifolia is an evergreen multi-stemmed shrub or a tree; it grows up to an altitude of 200 m. It is widespread in the humid tropical rainforest zone or in savannah woodlands of West and Central Africa. In Cameroon, the root are used to treat jaundice, yellow fever, rheumatism, abdominal pains and hepatitis while the bark is being used in the treatment of jaundice and loss of appetite (Donalisio et al., 2013). In Nigeria, the stem bark and roots of the plant are used against fever, jaundice, malaria, diarrhoea, dysentery, hypertension and diabetes (Okwori et al., 2008; Gidado et al., 2005). In Sudan, the plant is used to treat venereal diseases and fever while in Ghana; the leaves and stems are used for stomach problems and for treating sores (Abbiw, 1990). The anticonvulsant, anxiolytic and sedative properties of the roots of the plant in mice have been investigated (Bum et al., 2009). The anthelmintic, hypoglycaemic and anti-hyperglycaemic activity of the aqueous and ethanolic extract of the plant has also been reported (Onyeyili et al., 2001; Ademola et al., 2007).

The proximate composition of plant material is important as they show their respective percentage protein, fat, carbohydrate, fibre, ash, moisture and dry matter content of the plant. They also display their food values as well as minerals and vitamins. The leaves of *N. latifolia* are used extensively in the feeding of ruminants and also for treating different ailments. The fruit is eaten by both humans and animals when ripe and also used for treatment of diseases in traditional medicine (Eze and Obinwa, 2014). In view of this, the current research was designed to investigate the comparative nutritional compositions of the leaves, stem bark and root obtained from 50% ethanol-water extract of *N. latifolia* to determine their nutrition values. Hopefully, these may contribute to their health beneficial effects.

MATERIALS AND METHODS

Sample Collection

Fresh leaves, root, and stem bark of *N. latifolia* were collected from Ekiti State University, Nigeria and authenticated by Mr Femi Omotayo of the Plant Science

Table 1. The proximate composition of the leaf, bark and root of *N. latifolia.*

Parameter	Leaf	Stem bark	Root
	Concentration (%)		
Moisture	11.29±0.14	11.92±0.28	12.48 ±0.14
Protein	8.65±0.14	2.07±0.08	8.45±0.14
Fat	4.72±0.17	2.62±0.18	2.33±0.14
Ash	6.75±0.04	6.23±0.03	5.48±0.06
Crude fibre	8.20±0.21	13.35±0.18	8.36±0.14
Carbohydrate	55.80±0.42	63.91±0.55	62.90±0.06

n=2.

Table 2. The Mineral composition of the leaf, root and bark of *N.latifolia.*

Minerals	Root	Leaf	Stem bark
	Composition (mg/100 g)		
Iron	132.25±1.06	49.14±0.46	185.23±0.46
Zinc	12.2±0.42	8.18±0.04	15.36±0.04
Copper	2.03±0.04	1.23±0.04	1.33±0.04
Manganese	5.47±0.02	7.76±0.01	6.43±0.04
Chromium	0.01±0.00	ND	ND
Calcium	241.19±5.73	65.76±0.04	133.13±0.04
Potassium	66.78±0.66	42.68±0.19	54.23±0.32
Sodium	44.59±0.80	24.61±0.63	33.20±0.04

n=2, ND= Not detected.

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Preparation of Extracts

The leaves, root, and stem bark were washed with distilled water and air-dried at room temperature for two weeks. They were pulverized using a mechanical grinder. The powdered plant material was extracted with 50% ethanol-water; the extracts were filtered and evaporated to dryness with the aid of rotatory evaporator at 50ºC. The concentrated extracts were stored in an air tight sample vials pending analysis.

Proximate Analysis

The routine-analysis of food is termed the proximate or wende analysis (which followed the name of an experimental station 'wende' in Germany, a place well known for its experience in routine analysis which was developed by two German Scientists "Henneberg and Stohman" in 1865 (McDonald et al., 1995). The procedures for proximate analysis (moisture, ash, crude protein, crude fibre, ether extract (crude fat) and nitrogen free extractives or soluble carbohydrate), were by the methods described by (AOAC, 2005; Meyer, 2004; Pomeranz and Meloan, 2004; Wong, 2005).

Mineral Analysis

The minerals were determined using appropriate methods as illustrated by (Pomeranz and Meloan, 2004; AOAC, 2005). 5 g of each sample was dry-ashed in an electric furnace at 550ºC for 24 h. The resulting ash was cooled in a desiccator and weighed. The ash was dissolved with 2 ml of concentrated HCl and few drops of concentrated nitric acid (HNO_3) were added. The solution was placed in boiling water bath and evaporated almost to dryness. The content was then transferred to 100 ml volumetric flask and diluted to volume with deionized water. Appropriate dilutions were made for each element before analysis which was determined by Atomic Absorption Spectrophotometry (Pye, Unican SP9, Cambridge, UK).

RESULTS AND DISCUSSION

The ethanol: water (50:50) extract obtained from different parts (leaf, bark and root) of *N. latifolia*, showed variations in their mineral content and proximate compositions as presented in Tables 1 to 2. The mean proximate composition (%) of *N. latifolia* leaf, bark and root are presented in Table 1. The different plant parts generally possess moderate levels of moisture. However, the leaf had the lowest moisture content (11.29%) while the root had the highest level (12.48%). The moisture content of the leaf may be considered to be high when compared with 6.38% reported for *M. scandens* (Omoyeni and Adeyeye, 2009). High moisture content of samples may not allow a long shelf life because of microbial spoilage. The protein content of samples was in the range (2.07 to 8.65%). The leaf extract had the highest value 8.65%, followed by the root 8.45%. The values were higher compared to the reported value for *Crataegus populnea* stem (6.1 to 6.3 g/100 g) (Adebowale et al., 2013). The result is also comparable to 8.75 for *Hyptis suaveolens* stem (Ijeh et al., 2007. The low ash content of (6.75, 6.32 and 5.48%) in leaf, bark and root extract of *N. latifolia* plant, respectively reflect low organic content which are comparable to those reported for *Hibiscus esculentum (*8.00%).

The values are low when compared to *Occimum graticimum* (20.05%) (Dike, 2010). The protein content of 8.65, 2.07 and 8.45% for the leaf, bark and root, respectively shows the plant is a rich source of protein supplements for animal fed with the plant leaf as practised in many parts of Africa. However, the protein content is not high as reported for *Vitex Doniana* leaves (Umar et al., 2008), and 10.63% for *Peperomia pellucida* (Ooi et al., 2012). The fat content of 4.72, 2.62 and 2.33% for the leaf, bark and root extracts are low when compared with 24.03% (bark) and 32.04% (root) reported for *N. latifolia* (Egbung et al., 2013). The wide variation in the values may be due to collection time and extraction method employed. Low fat content in plant reveals that the plant is not an oil species and as such cannot be used either for industrial or domestic purposes. The crude fibre of the extract was found to be in the range 8.20 to 13.35%. High fibre content for the leaf of the plant causes drawback in human nutrition as they cause intestinal irritation and they are low in nutrient availability as human cannot digest them easily (Eze and Ernest, 2014). The fibre is higher in the bark 13.35 and root 8.36%. The estimated carbohydrate content for the leaf of *N. latifolia* has higher value when compared to some leafy vegetables such as *Mormordica balsamina* 39.05% (Hassan, 2008) and *Melanthera scanden* 31.82% (Omoyeni et al., 2012). The carbohydrate content 63.9 and 62.9% for bark and root of *N. latifolia,* respectively is also high when compared with other plant of the same family Rubiaceae (Gordon, 2000). Table 2, presents the mineral levels (mg/100 g) in the root, leaf and bark of *N. latifolia*. Generally, minerals from plants sources are less bio-available than those from animal sources.

In the present study, it was observed that *N. latifolia* were rich sources of most essential minerals as shown in Table 2 with Fe (132.25, 49.14 and 185.23), Zn (12.20, 8.18, 15.36), Cu (2.025, 1.23, 1.33), Mn (5.47, 7.76, 6.43), Cr (0.01, ND, ND) Ca (241.19, 65.76, 133.13), K (66.78, 42.68, 54.23) and Na (44.59, 24.61 33.20) for root, leaf and bark, respectively. Sodium and potassium are involved in body water balance and acid-base balance and is the major extra cellular and intracellular mineral,` respectively, failure to consume sufficient sodium when fluid and sodium losses are high can lead to hyponatremia. They are also involved in the transport of some non-electrolytes. The maintenance of osmotic equilibrium by Na can lead to serious disorders, like headache, tiredness, muscle cramps in the body (Nkafamiya et al., 2010). Calcium is majorly found in the skeleton. For the extract, calcium values were high in all the plant parts. This shows that the plant is rich in calcium. Calcium helps in forming and maintaining bone, blood clotting and muscle contraction. Zinc helps to form a large number of enzymes, many of which function in energy metabolism and in wound healing (Benowieez, 1981). It also helps in DNA synthesis, storage, release, and function of insulin and also in the development of sexual organs and bones. Iron is essential for haemoglobin formation. Iron-deficiency, anaemia is characterized by poor oxygen-carrying capacity, a condition that causes endurance problems in athletes. Phosphorus is essential in bone and teeth formation. Manganese is a trace mineral involved in bone formation, immune function, antioxidant activity, and carbohydrate metabolism. Its deficiency may result in paralysis and convulsion (Benowieez, 1981). Chromium is found in trace amount (0.01mg/100 g) in the root, while it is not detected in the leaf and bark of the plant.

CONCLUSION

We can conclude that the leaves, bark and root of *N. latifolia* are of substantial nutritive values and can play a great role as good sources of essential nutrients necessary for the maintenance of good health.

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