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Phytochemical and Nutritive Composition of *Uvariachamae* P. Beauv. Leaves, Stem Bark and Root Bark

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ABSTRACT

Uvariachamae is employed in African traditional medicine for the treatment of piles, ulcer, sore throat, cough, diarrhoea and urinary tract infection (UTI). In this study, the phytochemical and nutritional composition of root bark, stem bark and leaves were analysed using standard analytical methods. The results of the preliminary phytochemical screening indicate the presence of alkaloids, flavonoids, tannins, terpenes, phenols, carbohydrates, while deoxy sugar and phlobatannins were found to be absent in all the plant parts. Anthraquinones, saponins and cardiac glycosides were not found to be present in the leaves. Quantitatively, root bark, stem bark and leaves contained (mg/100 g); alkaloids (3.40, 0.80 and 1.40), cardiac glycosides (0.80, 0.64 and 0.53), flavonoids (6.70, 2.50 and 5.13), phenols (3.20, 4.30 and 1.76) respectively. The proximate composition estimation are: carbohydrate (91.83- 87.76%), caloric value (387.57- 375.87%), fibre (2.93- 2.40%), fat (0.80- 0.50%), protein (3.93- 5.70%), ash (1.30- 5.51%) and moisture (9.43- 79.80%) in the root bark, stem bark and leaves, with the highest carbohydrate and caloric values observed in the root bark. The percentage estimation of the antinutrients content for root bark, stem bark and leaves also revealed hydrocyanic acid values ranging from 0.97 to 1.26, phytate 0.24- 1.54, total oxalate 5.66- 11.40 and soluble oxalates 3.08- 6.38. The present findings suggest that the plant may be a potent site for drugs and food supplement.

Keywords: Antinutrient, Food supplement, Nutrients, Phytochemicals, *Uvariachamae*

INTRODUCTION

Plants have continued to be vital therapeutic agents and sources of food because they contain bioactive substances and nutritionally potent elements. They, in addition, have significant physiological functions on biological systems (Ogbuanu*et al*., 2020). Nutrients play important role in satisfying human needs for energy, body building and other life processes, a deficiency may results in abnormalities such as impaired mental health, kwashiorkor, oedema, organ failure, weak immune system, poor vitamin absorption, increase cancer risk, heart disease and organ failure (Adnam*et al*., 2012). Phytochemicals on the other hand act as antioxidants by preventing the occurrence of oxidative chemical species (OCS), stimulation of antioxidant repairing mechanism and scavenging capacity for radicals in the system. Utilization of plants for medicine and food has a relieving role, especially, in Africa and sub-Sahara regions where earnings or income of the populace are poor and meagre (Koroma and Ita, 2009). *Uvariachamae P. Beauv.* is among plants reportedly utilised in African ethnomedicine for treatment and management of various health conditions. *Uvariachamae*is a climbing large shrub native to the tropical rain forest of West and Central Africa. It grows in wet and coastal shrub lands and has a reported height of 3.6 to 4.6 m (Lim, 2012). In English, it is known as *finger root* or *bush banana* (Abu *et al*., 2018). It is identified by names such as: *Nkarika Ikot* by the Ibibio people of Akwa Ibom State, *Kaskaifi*by the Hausas, *Okooja* by the Yorubas, *Mmimi ohia* by the Igbos in Nigeria and *Akotompo* by the Akan-fante people of Ghana (Abu *et al*., 2018). The root bark, stem bark and leaves have been widely used in ethnopharmacology for different conditions. For example, the decoction of the stem bark is used in the treatment of diarrhoea (Igoli*et al*., 2005)while the leaves are used for the treatment of wounds, sores, injuries, swellings and yellow fever (Kola *et al*., 2008). More so, the root decoction is used as a purgative and to cure respiratory catarrh and the root extract is used in phytomedicine for the treatment of piles, menorrhagia, epistaxis, haematuria and haemolysis (Abu *et al*., 2018). Several metabolites have been isolated from stem bark and root bark of *Uvariachamae*including Pinocembrin, Chamanetin, Uvaretin, Uvarinol and Pinostrobin among others. Essential oil constituents from the leaves and root also revealed the presence of 1-Nitro-2-pheneylethane, Linalool, Germacrene D, (E)-Caryophyllene, (E)-β-Ocimene, (E)-

Nerolidol, 1,8-Cineole, 1-*epi*-Cubebol, α-Humulene, α-Copaene and others in trace quantities (Abu *et al*., 2018). Phytochemical screening of the methanol extract showed the presence of alkaloids, glycosides, saponin, tannins, flavonoids, terpenoids and phenols (Oluremi*et al*., 2010). Antioxidant, antidiabetic, antimicrobial, antivenom, insecticidal, hepatoprotective, antimalarial, cytotoxic, anti-inflammatory and oxytocic activities of this plant have also been reported (Abu *et al*., 2018). Proximate analysis of the root was reported by Olumese and Onoagbe, (2017). We observed however that to date, no scientific report has been published on the comparative analysis of nutrients and phytochemical constituents of this plant. Hence, this study compares phytochemicals and nutritive constituents of *Uvariachamae* leaves, stem bark and root bark with the aim of documenting the relevant information.

MATERIALS AND METHODS

Plant sample collection and preparation

Leaves, stem bark and leaves of *Uvariachamae* were harvested from a forest in ItakUkap, Ikono Local Government Area in Akwa Ibom State, Nigeria. Identification was carried out by a plant taxonomist at the University of Uyo, Akwa Ibom State, Nigeria. The plant parts were washed thoroughly and divided into three groups. They were shade dried, pulverised, packaged in an air-tight glass jars and stored at room temperature until further analyses.

Preparation of Ethanol extracts

The method reported by Oluremi*et al*., (2010) was adopted with little modification. Dried root bark, stem bark (250 g each) and dried leaves (350 g) were separately weighed and percolated with 10 L of 95 % ethanol, at room temperature for 14 days. After 14 days of intermittent shaking, the contents of the flasks were filtered and concentrated to dryness *in vacuo* using a rotary evaporator to obtain 28, 11 and 17 g of crude ethanol extracts representing in w/w yield of 11, 3 and 7% root bark, stem bark and leaves respectively. The extracts were stored in freezer until used.

Phytochemical analyses

Preliminary phytochemical analysis was conducted according to methods described by Yadav and Agrawala (2011), Patle*et al*., (2020). Quantitative phytochemical determination for Alkaloids, Flavonoids, Cardiac glycosides and Phenols were carried out according to methods described by Edeoga*et al*., (2005).

Proximate analysis

Proximate composition of leaves, stem bark and root bark for carbohydrate, ash, and moisture were determined by methods described by AOAC (2006). Crude protein, fibre and fat content were determined by methods described by Oyeyemi *et al*. (2017). Total ash content was determined by furnace incineration reported by Antia*et al*., (2005).

Antinutrient composition

Oxalate and phytate were determined according to the method described by Keyata*et al* (2020). The oxalate determination involves the initial digestion of pulverised plant parts before precipitation followed by the final permanganate titration. Hydrogen cyanide content was determined based on the method reported by Ukhun and Nkwocha, (1989).

Statistical analysis

The results obtained are presented as mean standard deviation. Microsoft Excel package was utilised for the analysis of variance (ANOVA). Bonferroni correction method was used for test of significance between mean ($p<0.05$).

RESULTS AND DISCUSSION

Table 1 presents the results of the percentage weight of *Uvariachamae* ethanol extracts. The percentage weight of the crude ethanol extracts for the root bark, stem bark and leaves were 11, 3 and 7% respectively, indicating that the highest extract recovery was from the root bark.

Table 1: Percentage weight of *Uvariachamae* Extracts

S/N	Plant part	Weight of extract (g)	Percentage yield (%)
1.	Leaves	17.55	7
2.	Stem bark	11.08	3
3.	Root bark	20.05	11

Table 2 presents the results of the preliminary phytochemical constituents of the ethanol root bark, stem bark and leaves extracts. The results reveal that alkaloids, saponins, tannins, flavonoids and terpenoids were found to be present in all the plant parts studied. Deoxy sugar and phlobatannins were found to be absent in all the parts investigated.

This result agrees with other works (Okwu and Iroabuchi, 2009; Oluremi*et al*. 2010; Okwuosa*et al*. 2012; Olumese*et al*. 2017) and thus, further support the ethnomedicinal uses of this plant.

Table 3 presents the results of percentage phytochemical constituents (mg/100 g) of *Uvariachamae* root bark, stem bark and leaves. The flavonoids and alkaloids levels were found to be significantly higher (P < 0.05) in the root bark (6.70 and 3.40%) than those in the stem bark (2.50 and 0.80%) but phenolic contents was found to be highest in the stem bark (4.30%) but lowest in the leaves (1.76%). The abundance of alkaloids and flavonoids in the root bark is an indication of its antioxidant effect, and thus supports its reported pharmacological activities (Abu *et al*., 2018).

Table 2: Preliminary phytochemical constituents of *Uvariachamae* Extracts.

S/N	Phytochemicals	Leaves	Stem bark	Root bark
1.	Alkaloids	+	+	+
2.	Saponin	-	+	+
3.	Flavonoids	+	+	+
4.	Tannins	+	+	+
5.	Terpenes	+	+	+
6.	Cardiac glycosides	-	+	+
7.	Phenol	+	+	+
8.	Carbohydrates	+	+	+
9.	Anthraquinones	-	+	+
10.	Deoxy sugar	-	-	-
11.	Phlobatannins	-	-	-

+ Present-Absent

High phenolic contents in the root bark and stem bark of the plant also suggest that this plant could act as an anticlotting agent, immune enhancer and hormone modulator (Amakoha*et al*., 2002). The presence of other phytochemicals such as tannins, saponin and glycosides also supports its wide ethnomedicinal uses, for example, in the treatment of intestinal disorder, piles, heart disorders, as analgesic and as dietary supplement (Oguntimein*et al*., 1989).

Table 4 presents the results of the percentage proximate composition (mg/100g) of *Uvariachamae*. The results indicated that highest caloric, carbohydrate and fibre contents of 387.5, 91.83 and 2.93% were found in the root bark but least values of 375.87, 87.76 and 2.40% were observed in the leaves.

Table 3: Percentage phytochemical composition of *Uvariachamae*on dry weight basis (mg/100g).

S/N	Phytochemical	Root Bark	Stem Bark	Leaves
1.	Alkaloids	3.40±0.20*	0.80±0.20	1.40±0.01
2.	Glycosides	0.80±0.01	0.64±0.05	0.53±0.04
3.	Flavonoids	6.70±0.20*	2.50±0.10	5.13±0.30*
4.	Phenols	3.20±0.10*	4.30±0.10*	1.76±0.10

Values are expressed as mean±standard deviation of triplicate determinations. Asterisk indicates values that are significantly different in the group (P < 0.05).

The moisture contents were found to be highest in the leaves (79.8%) and least in the root bark (9.43%). Comparatively, this value is lower than that reported for *Sidaacuta* (58.8%) (Ravidran, 1993), but close to that of *Cucurbita spp*. (72.92%) (Blessing *et al*., 2011). Higher percentage moisture contents values of 79.98, 87.84, 89.47 and 83.46 have previously been reported for *Corchorus olitorius*, *Ocimumgratissimum, Talinum triangulare*and *Telfariaoccidentalis*respectively (Adeniyi *et al*., 2012). Moisture content of any food is an index of its water activity. And hence low moisture content reduces food contamination by promoting stability and insusceptibility to microbial attack. The observed moisture value for the leaves of *Uvariachamae* implied a prolong drying time which may lead to high cost of preservation. It has been observed that the crude fibre content was higher in the root bark in comparison to stem bark and leaves. Crude fibre content in the root bark (2.93%) was comparable to the reported values for *Citrus sinensis* seed (2.98%) (Egbuonu and Osuji, 2016) and *Eleusinecoracana* (3.10%) (David *et al*., 2014), both are popular edible seed in most West African countries. Crude fibre in foods enhances food digestion, aids effective elimination of waste and can lower serum cholesterol and heart diseases. (Ayoola and Adeye, 2009). Crude fat composition was in the range of 0.5 to 0.8%; with highest value observed in the leaves (0.80%). This value is in the vicinity of that reported for *Eleusinecoracana* seed (0.83%) (David *et al*., 2014), however, lower compared to values reported for *Moringa oleifera*leaves (2.11%) (Ogbe and John, 2011). The lipid, aside from its role as targeted energy source, also serves as a mobile phase for the transport of fat-soluble vitamins.

Table 4: Percentage proximate composition of *Uvariachamae*on dry weight basis (mg/100g).

S/N	Parameter	Root Bark	Stem Bark	Leaves
1.	Moisture	19.59±0.05[d]	9.43±0.07[d]	79.80±0.10[d]
2.	Ash	1.30±0.20[b]	2.40±0.10[b]	5.51±0.02[b]
3.	Protein	3.93±0.20[b]	5.70±0.10[a]	4.40±0.10[b]
4.	Fat	0.50±0.10[a]	0.70±0.02[c]	0.80±0.10[c]
5.	Fibre	2.93±0.20[b]	2.23±0.02[a]	2.40±0.10[a]
6.	Carbohydrate	91.83±0.05[c]	88.67±0.08[c]	87.76±0.06[c]
7.	Caloric value	387.57±0.91[c]	383.81±0.32[d]	375.87±1.24[d]

Values are mean±standard deviation of triplicate determinations. Mean with different superscripts in the same row are significantly different ($P < 0.05$).

It insulates and protects internal tissues and aids important cell functions. Also, foods that are low in fat content reduces the risk of atherosclerosis, cancer and aging (Antia*et al*., 2005). The values obtained for crude fat content in the leaves, stem bark and root bark demonstrated that *Uvariachamae* is a good source of low-fat food. The carbohydrate content in stem bark (88.67%), root bark (91.83%) and leaves (87.76%) were found to be higher than the reported values for *Eleusinecaracana*(76.43%) (David *et al*., 2014), and *Indigoferaastragalina*(75.74%) (Gafar*et al*., 2011). Both *Eleusinecaracana and Indigoferaastragalina*are consumed as carbohydrate foods in Niger Delta, Nigeria. Summarily, *Uvariachamae* is a good source of carbohydrate food when compared to the 130 grams per day recommended dietary allowance. The caloric value was found to be highest in the root bark with the least value observed in the leaves. The mean caloric value was 382.42 kcal/100g. This value is in the range of the reported value for *Eleusinecorocana* (382.27 Kcal/100g) (David *et al*., 2014), and higher compared to values reported for *Achyranthes aspera* (195.30 Kcal/100g) (Hussain *et al*., 2013), but it appeared slightly lower than that reported for *Chrozophora tinctorial* (395 Kcal/100g) (Dastagir*et al*., 2013). Therefore, the inclusion of this plant parts as dietary supplement and the subsequent daily consumption could enhance the basal metabolic rate. The crude protein contents values in the stem bark, root bark and leaves were 5.7, 3.39 and 4.40% respectively. These values are in range to percentage crude protein contents values of 3.9, 5.99, 6.77 and 7.7% reported for some leafy and medicinal vegetables such as *Piper umbellatum, Medicago denticulate, Citrus sinensis* peel and *Peperomia pellucida* respectively(Nasiruddin *et al*., 2012; Egbuonu and Osuji, 2016). These are however lower in comparison to values of 14.60 and 17.01% reported for *Ocimiumgratissimum* and *Moringa oleifera* respectively (Ogbe and John, 2011). The ash contents values were highest in the leaves (5.51%) and lowest in the root bark (1.30%). These values are however within the range listed by Kunle, (2000) for certain medicinal plants. Table 5 presents the results of the antinutrients composition of *Uvariachamae* (mg/100g dry matter).

Table 5: Antinutrient contents of *Uvariachamae*on dry weight basis (mg/100g).

S/N	Antinutrient	Root Bark	Stem Bark	Leaves
1.	HCN	1.26±0.20[d]	0.97±0.01[a]	1.51±0.02[a]
2.	Total oxalate	6.32±0.20[c]	5.61±0.20[c]	11.40±0.40[b]
3.	Soluble oxalate	4.07±0.10[a]	3.08±0.10[a]	6.38±0.10[a]
4.	Phytate	0.38±0.01[c]	0.24±0.02[b]	1.54±0.02[b]

Values are mean±standard deviation of triplicate determinations. Mean with different superscripts in the same row are significantly different ($P < 0.05$).

The Hydrocyanic acid content values were higher in the root bark compared to the leaves and the stem bark, while mean hydrocyanic acid value in the plant was 1.25 mg/100 g. This value is lower compared to the reported value for *Ipomoea batatas* leaves (30.24 mg/ 100 g) (Antia*et al*. 2005), though higher than those of *Cebapentandra* (0.45 mg/ 100 g) (Enechi*et al*., 2013) and *Lachnocladium sp*p. (0.75 mg/ 100 g) (Olagunju*et al*., 2013). Blum and Woodring, (1962) reported that the lethal dose of hydrocyanic acid for adult man was 50-60 mg/kg indicating that *Uvariachamae* plant is safe for consumption. Levels of percentage soluble oxalate was found to be 4.07, 3.08 and 6.38%, while the observed percentage total oxalate contents were found to be

6.32, 5.61 and 11.40% in the root bark, stem bark, and leaves respectively. There was no significant difference (P<0.05) in the total oxalate contents in the stem bark and the root bark, however, results indicated that the oxalate content was highest in the leaves. Oxalate and oxalic acid are organic acids which are very powerful oxidants that initiate free radical attacks on cells and organs (Liebman and Chai,1997). They form complex with some metals of group II leading to the formation of insoluble oxalate salts which result to oxalate stones and interfering with utilization of minerals in the body. The lethal dose of oxalate in man is 2-5 g (Onwuka, 2005). Phytic acid level in *Uvariachamae* was found to be highest in the leaves with a mean value of 0.72%. it is known that phytic acid has a strong ability to chelate multivalent metal ions, especially, zinc, calcium and iron. This would then result in poor bioavailability of such ions in the body as they are precipitated in the form of insoluble complexes (Gupta *et al*., 2006).

CONCLUSION

The results of this study revealed that *Uvariachamae* root bark, stem bark and leaves contain plant phytochemicals such as alkaloids, flavonoids, tannins, phenols and terpenes in the ethanol extracts of the parts studied. The stem bark, root bark and leaves of this plant are therefore potential sources of bioactive substances which could further be explored for medicinal purposes. The results further indicate that the root bark has the highest levels of carbohydrate, caloric value and crude fibre contents, which, could be a potential source of food nutrients for food industry. Further characterisation/processing and maybe, inclusion of this plant as dietary supplements and as drugs are encouraged.

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