*JHER Vol 26 (1) September 2019, pp. 150 - 160*

# Proximate and Anti-nutritional Properties of Two Lesser Utilized Leafy Vegetables (*vitex doniana* and *zanthoxylum zanthoxyliodes*)

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**Abstract**

The objective of the study was to ascertain the nutrient and anti-nutrient content of *zanthoxylum zanthoxyliodes, vitex donenia* leaves. Standard laboratory analytical method of AOAC procedure was used to determine the proximate composition of the samples. Analysis was carried out in triplicate, including moisture, protein, fat, ash, fibre and carbohydrate content of each sample. Data were analyzed using means and t-test at 0.05 level of significance. Results show that various nutrients were present in a considerable amount in leaves, this varied significantly between the samples at ($P<0.05$) and ($P>0.05$). The result on proximate composition shows that *vitex doniana* has the highest value for ash (14.25%), fibre (23%), *zanthoxylum zanthoxyliodes* has the highest value for moisture (37.7%), fat (3.4%), protein (6.99%) and carbohydrate (37.91%). The result on anti- nutrient value revealed that *vitex doniana* has the highest value in phytate (3.76m/100g) *zanthoxylum zanthoxyliodes* has the highest value of tannin ( 0.2335%), oxalate (0.4775%). The result showed that the vegetables contained an appreciable amount of nutrients and low level of anti- nutrient and could be included in diets to supplement our daily allowance needed by the body.

**Keywords**: *vitex-donaiana, zanthoxylum-zanthoxyliodes*, proximate, anti-nutrient, oxalate, tannin.

## Introduction

Leafy vegetables are plant parts that are naturally low in fat, salt and sugar, making them excellent food choice. They are highly beneficial for maintaining health and preventing diseases. Dark green leafy vegetables provide high amounts of micro minerals which play vital roles in nutrient metabolism and retard degenerative diseases. Both wild and cultivated green leafy vegetables are used in food preparation. High intake of vegetables provides the body with vitamins,

dietary fibre and minerals. Eating green vegetables that are rich in fibre may help regulate the digestive system, thereby aiding bowel health and lowering the risk of colon cancer (Asaolu, *et. al*, 2012). Foliate intake can also reduce the risk of heart related diseases such as heart attack and stroke. These health benefits of vegetables spring from a range of their phytonutrients composition (Sheela, *et. al*, 2004).

Leafy vegetables include cultivated and wild species. The wild tyes are most often underutilized due to lack of popularity (Adejumo, *et. al*, 2013). Lesser utilized vegetables are vegetables of any given locality. Such vegetables originate from an area and may or may not be confined to that particular region. They account for about 10 percent of the world's higher plants often regarded as weed. Some local vegetables grow in the wild and are readily available in the field without any formal cultivation. Some of these local vegetables are less utilized due to lack of awareness of their nutritional values (Lykke Padonou, 2019). Vegetables that may not be found in the regular market belongs to this category. These vegetables are often rich source of carotene, ascorbic acid, riboflavin, folic acid and minerals like calcium, iron and phosphorous (Nnamani *et al*., 2007). Maudu (2006) and Nnamani, *et. al* (2009) reported 47.00 to 442.00mg/100g and 54.06 to 90.10mg/100g values respectively for some lesser utilized indigenous vegetables. Two such vegetables are *Zanthoxylium zanthoxyloides* (*nka* leaf) and *Vitex doniana* (*uchakuru* leaf). They are often found in the forest and are used in soup preparation

*Zanthoxylium zanthoxyloides* (*Nka leaf*) is a prickly shrub or low branching shrubby very prickly tree usually growing up to 12 meters tall, occasionally to 16 meters. The tree can be use to provide medicines, food flavouring, timber and other commodities for the local people. This plant can be used as a relief from illness, as health care products fragrances, flavours, sweetness and as materials for pest control. The decoction of the root is used as a mouthwash and against a sore throat (Matu, 2011). The sap from the pulped bark is applied as eye drops to treat eye infections notably conjunctivitis with pus. In Ghana root and stem bark powder is taken to treat whopping cough (Arbonnier, 2004). This plant occurs more abundantly in the Savanah and dry forest vegetation and is found in parts of South Western Nigeria.

*Vitex doniana (Uchakuru*) is a medium sized deciduous tree, with 8 – 18m high with a levy rounded crown and a clear bole up to 5m. It has rough pale brown or greysish –white, rather smooth with vertical tissues. It can be used for food, medicinal purposes and as a source of fire wood. Its fruit is edible and is occasionally sold. The leaves serve as a vegetable, it serves as protective food, which are highly beneficial for the maintenance of good health and prevention of diseases

(Sheele *et al* ., 2004; Nnamani *et al*., 2007). This study therefore tends to determine the proximate and anti-nutritional properties of *Nka* and *uchakuru* leaves.

*Nka* and *Uchakuru* leaves are almost consumed on daily basis in Ebonyi State the study area. The two vegetable are often used in the preparation of soups, sauces, yam pottage, etc. *Nka* leaves in particular are used for preparation of various kinds of soup ranging from thin soups to thick soups. The astringent nature of *nka* made the people to believe that it has healing properties especially for diseases of the mouth. *Uchakuru* on the other hand is believed to boost the blood level of the body.

Interaction of nutrient often occurs when two food materials are consumed together (Bushra, *et. al*, 2011). This interaction of nutrients may lead to the formation of an anti or pro-nutrient. Since *nka* and *uchakuru* leaves are consumed on daily basis, it is necessary to ascertain and compare their nutrient and anti-nutrient properties.

**Purpose of the study**

The main purpose of this study was to ascertain the nutrient and anti-nutrient compositions of two lesser utilized leafy vegetables (*Vitex doniana*) *uchakuru* and (*Zanthoxylum zanthoxylodes*) *nka* leaves. Specifically, the study determined:

1. nutrient content, namely moisture, protein, ash, fibre and carbohydrate of the two lesser utilized leafy vegetables.
2. antinutrient content , namely tannin, oxalate and phytate of the lesser utilized leafy vegetables.

**Research Question**

1. What is the nutrient content (protein, fat, ash, fibre and carbohydrate) of lesser utilizes vegetables.
2. What is the antinutrient (tannin, oxalate and phytate) content of the lesser utilized leafy vegetables.

**Materials and method**

***Design of the study*: E**xperimental research design was adopted for this study. A true experimental research design which involved a laboratory analysis was adopted. The steps include, preparation of the sample/materials, proximate analysis, moisture content, crude protein, fat, fibre, ash, carbohydrate content, and anti nutrient determination. Data collected were analysed using mean, standard deviation and t-test.

***Materials*:** The vegetables that were used for this study, *Vitex donenia* and *Zanthoxilum zanthoxilodies* were purchased and procured from Ekeimoha Market in Ezza South Local Government Area and Okaria Amana forest in Ebonyi State, Nigeria respectively. The wild vegetables were identified by their local names. The vegetables were taken to the Department of Crops Science at Faculty of Agriculture and Natural Resources Management, Ebonyi State University Abakaliki for characterization and

identification with their botanical names.

***Preparation of Materials/Samples*:** Fresh leaves of two indigenous tree species used as vegetables (*Vitex donenia* and *Zanthoxilum zanthoxilodies*) were sorted and put in separately numbered polythene bags. Contamination, colour change or browning were prevented. Prior to analytical work the samples were thoroughly washed with deionised water and were pounded with ceramic mortar and pestle. The pounded leaves were transferred to air tight container. This were analysed while still fresh.

***Laboratory/Proximate Analyses:*** Standard laboratory analytical method of Association of official analytical chemist (AOAC, 2005) procedure was used to determine the proximate composition of the samples. Analysis for each sample was done triplicate which include – Analysis covered Moisture, protein, fat, ash, fiber and carbohydrate contents, anti-nutrients (oxalate, phytate).

***Moisture content*:** The moisture content of the samples was determined using AOAC (2005) procedure. Washed porcelain dishes were dried in a gallenkemp oven at $100^0$c for about 2hours, cooled in a desiccator and was weighed. Two grams (2g) of each of the sample was weighed into the weighed dishes and placed in the oven at $100^0$C for 24hours. The dishes containing the samples was cooled in a desiccator, weighed and dried.

The % moisture was calculated using the formular below: $\frac{W_2 - W_3}{W_2 - W_1} x \frac{100}{1}$

Where $W_1$= Weight of the empty aluminum dish; $W_2$= Weight of the dish with sample before drying; $W_3$= Weight of dish with sample after drying.

***Crude Protein*:** Crude protein was determined by automatic micro kjeldahl method of AOAC (2005). Crude protein was estimated by multiplying nitrogen value with N conversion factor 6.25 (N x 6.25) % $N_2$ x 6.25% $N_2$= Ty x 0.1 x (0.014) x 100.

***Fat*:** Fat content of the samples was determined using the soxhlet extraction method. Flask was washed, dried, cooled and weighed prior to addition of 2g of the sample. The samples was weighed into filter paper and introduced into thimble. Petroleum ether was added to the flask for the extraction in the soxhlet apparatus. After which the extract was dried in an oven for 15 minute at $100^0$c for the removal of any remaining solvent, It was cooled in a desiccator and reweighed.

% fat =

$$\frac{\text{weight of extract cup} - \text{weight of cup}}{\text{Original weight of sample}} x \frac{100}{1}$$

$$\% \text{ fat} = \frac{W_2 - W_1}{\text{Original weight of sample}} x \frac{100}{1}$$

***Ash Determination*:** The ash content of the samples was determined using the method AOAC (2005). Two grams of each of the sample was weighed into crucible heated in a furnace at a temperature of $600^0$C for about three

hours, cooled in a desiccator and was reweighed. The crucible was weighed as ($W_1$), the crucible with the sample as ($W_2$) and the sample with the crucible after ashing as ($W_3$).

$$\%\text{Ash} = \frac{W_3 - W_1}{W_2 - W_1} x \frac{100}{1}$$

Where $W_1$= Weight of the empty crucible; $W_2$= Weight of crucible with sample before ashing; $W_3$ = Weight of crucible with sample after ashing.

***Fibre Determination*:** Two grams of the sample was defatted with petroleum ether. The sample was boiled under reflux for about 30 minutes with 20ml of a solution containing 1.25gof $H_2SO_4$per 100ml of solution. The solution was filtered through linen of several layers of cheese cloth on a fluted funnel and washed in boiling water until the washing was no longer acidic. The residue was transferred to the beaker and was boiled for 30minutes with 200ml of solution. The final residue was filtered through a thin but close pad of washed and ignited asbestos crucible the residue was dried in an electric oven, and was reweighed and then incinerated, cooled and weighed. The loss in the weight after incineration x 100 will be the percentage of crude fibre.

$$\%\text{ crude fibre} = \frac{W_1 - W_2}{W_0} x \frac{100}{1}$$

Where $W_0$= Dry weight of sample; $W_1$= Weight of crucible + Residue; $W_2$=Weight of crucible + ash

***Carbohydrate Content*:** Total carbohydrate content was determined by the difference (substation of crude protein, moisture, fat, fibre and ash content from 100%). The total carbohydrate of each of the sample was the different.

% carbohydrate = 100 – (% protein + % fat + % ash + % crude fibre + % moisture).

**Anti-Nutrients**

***Tannin*:** This was determined by Folin Denis colometric method described by (A.V.AC 1990).Two grams (2g) of the leave sample was put inside a volumetric flask and 50ml of distilled water was dispensed inside the volumetric flask. The mixture was shaken for 30 minutes at room temperature and filtered to obtain the extract. A standard tannic acid solution was prepared, 2ml of the standard solution and equal volume of distilled water was dispersed into a separate 50ml volumetric flask to serve as a standard and reagent bank respectively. Then 2ml of each of the sample extract was put in their respective labelled flask. The content of each flask was mixed with 35ml of distilled water and 1ml of the Folin Denis reagent was added to each. This was followed by 2.5ml of saturated $Na_2C03$ solution.

$$\%\text{ Tannin} = \frac{100}{W} x \frac{au}{as} \text{ x C x } \frac{v}{va}$$

***Oxalate*:** The oxalate content was determined by a method described by AOAC (1990). Two grams (2g) of the sample were weighed out and extracted thrice at $50^0$C and stirred for 1hour with 20ml of 0.3ml HCL. The combination of the extract was diluted to 100ml with distilled water and used for total oxalic estimation. The oxalate was estimated

by pipetting about 5ml of the extract which was made alkaline with 1ml of 5m Ammonium hydroxide. About 3 drops of phenolphthalein was added to the extract and acetic acid was added in drops. Also about 1ml of 5% aqueous Cacl was added to the mixture and allowed to stand for 2hours after which it was decanted and the precipitated, washed three times with hot water, thoroughly mixed and centrifuged each time in the test tube, 2ml of 3m $H_2SO_4$ was added and the precipitate was dissolved by warming in water bath at $75^0$C.The content of the test tube was titrated with freshly prepared 0.001m $KMNO_4$ at room temperature until the pink colour appeared throughout the solution. This was warmed at $75^0$C and the titration continued until the pink colour persisted.

% oxalate=vt/ws x vme x titre

Where vt=total volume of titrate; ws =weight of sample; vme=volume - mass

Equivalent (ie $1cm^3$of 0.05m $KMNO_4$ is equivalent to 0.00225g.

***Phytate*:** The phytate content was determined by a method described by (Hang and Lautzsch, 1983). Two grams (2g) of the sample was soaked with 20ml of HCL for 3hours.The sample was filtered and the filtrate was collected. 0.5ml of the extract was put with 1ml of ferric ammonium sulphate solution in a test tube and stoppered. The mixture was boiled for 30 minutes in water bath, the tubes were cooled in ice for 15mins and allowed to adjust to room temperature before solution and absorbance measured at 519nm against a reagent blank in a spectrophotometer. Concentration of the phytic acid was obtained from a standard curve made from standard phytic acid solution.

% phytate $= \frac{An}{As} \text{ x c x } \frac{100}{w} \text{ x } \frac{vf}{va}$

**Data Analysis**

Three sets of data were collected for each nutrient. Data were analysed using percentages, means, standard deviation and t-test at $P<0.05$ level of significance.

**Findings**

Data on proximate composition of two lesser utilized vegetable *vitex doniana and zanthoxylum zanthoxyliodes* are presented in Table 1.

**Table 1:** Proximate composition of *vitex doniana and zanthoxylum zanthoxyliodes*

| S/N | Sample code | A | B |
|---|---|---|---|
| 1 | Moisture % | 32.30±0.473 | 37.70±0.857 |
| 2 | Fat % | 1.70±0.0816 | 3.40±0.160 |
| 3 | Ash % | 14.25±0.048 | 7.75±0.040 |
| 4 | Fibre % | 23.00±0.81 | 6.25±0.040 |
| 5 | Protein % | 6.96±0.008 | 6.95±0.024 |
| 6 | Carbohydrate % | 21.79±0.008 | 37.91±0.008 |

*A = *vitex doniana;* B = *zanthoxylum zanthoxyloide*

Table 1 shows the percentage protein, fat, fibre, moisture, Ash and carbohydrate. The percentage moisture content of *vitexdoniana* and *zanthoxylum zanthoxyloides* sample ranged from 32.30 to37.70%. The obtained result for the two sample shows that the sample named *zanthoxylum zanthoxyloides* had the highest moisture content of 37.70 %; while *vitex doniana* had the low moisture content of 32.30%. There were significant different at (P<0.05) among the sample.

The percentage fat content of the two sample *zanthoxylumzanthoxyloides* and *vitexdoniana* are presented in Table 1. From the table, showsthat the fat content ranged from 1.7-3.4 (%) respectively.The obtained result shows that sample B *zanthoxylum zanthoxloides* had the highest fat content of 3.4% while sample *vitex doniana* had the least/lowest of value of 1.7%. there were significant different at (P<0.05) among the sample.

The percentage ash content of two sample *vitex doniana* and *zanthoxylum zanthoxyloides* are presented in Table 1 The table shows that the ash content ranged from 14.25 to 7.75% respectively. The obtained result shows that sample A *vitexdoniana* had the highest ash content of 114.25% while sample B *zanthoxylumzanthoxyloides* had the lowest value of 7.75%. There were significant different at (P<0.05) respectively.

The percentage fibre content of the two sample *vitexdoniana* and *zanthoxylumzanthoxyloides* are presented in Table 1. From the Table shows the fire content of these samples to range from 23 to 6.25%. There were significant different at (P<0.05) among the sample. This result shows that sample A *vitexdoniana* had the highest value of 23% while sample B *zanthoxylumzanthoxyloides* had the lowest value of 6.25% for fibre.

The percentage crude protein of two sample *vitexdoniana* and *zanthoxylumzanthoxyloides* are presented in Table 1. From the Table, 1 shows the percentage crude protein to range from 6.96 to 6.96%. From the statistical analysis there were no significant difference at (P>0.05).

The percentage carbohydrate content of the two sample *vitexdoniana* and *zanthoxylumzanthoxyloides* are presented in Table 1. From the table, shows the carbohydrate content of the sample to range from 21.79 to 37.91% with sample B *zanthoxylumzanthoxyloides* having the highest and sample A *vitexdoniana* having the lowest. There were significant different at (P< 0.05).

**Anti-Nutrient**

**Table 2:** Anti-nutrient content of *vitex doniana* and *zanthoxylum zanthoxyloides*.

| S/N | Sample code | A | B | LSD |
|---|---|---|---|---|
| 1. | Phytate ml/100g | 3.760 ±0.008 | 3.548±1.669a | 0.0246 |
| 2. | Tannin % | 0.228±0.25 | 0.2335±0.008 | - |
| 3. | Oxalate% | 0.2378±0.0007 | 0.4775±0,00016 | - |

* A= *vitex doniana;* B =*zanthoxylum zanthoxyloides*

Table 2 shows the percentage and ml/100g of *vitex doniana* and *zanthoxylum zanthoxyloides*. The table also shows the ml/100g of phytate, percentage tannin and oxalate.

***Phytate*:** The phytate content in the two samples of *vitexdoniana* and *zanthoxylum zanthoxyloides* are presented in Table 2, the table shows the phytate content of the two samples range from 3.76 to 3.548 ml/100g respectively. It also shows that sample A, *vitexdoniana* had the highest phytate content of 3.76ml/100g and sample B *zanthoxylumzanthoxyloides* had the lowest of 3.548ml/100g. There were significant different at (P<0.05) among the samples.

***Tannin Content*:** The tannin content of *vitex doniana* and *zanthoxylum zanthoxyloides* are presented in Table 2. These range from 0.2275 to 0.2335 %. The result also shows that the *zanthoxylum zanthoxyloides* had the highest tannin value of 0.2335 %. There were no significant different at (P>0.05) among the sample.

***Oxalate Content*:** Table 2 shows that the oxalate content of the two samples ranged from 0.2887 to 0.4775% respectively. The result obtained showed that the *zanthoxylumzanthryloides*had the highest oxalate value of 0.4775% while *vitexdoinana* had the lowest value of 0.2881%. There were no significant different at (p>0.05) among the sample.

**Discussion**

The high moisture content observed over them may be due to the genetic factor, naturally, as their name varies. This high moisture content observed in them may show that the sample are liable to microbial attraction by micro-organism and other phenomenon that may led to quick damage. The result also shows that the moisture are higher than the moisture content of *zanthoxylum zanthoxyliodes* as reported by Oselebe, 2013 and Olujobi, 2015 for *vitex doniana* whom reported on oven dried to ranged from 10.8- 28% when dried.

This result obtained shows that the *zanthoxylum zanthoxyoides* is a good source of fat compared to *vitexdoniana* sample that had the lowest fat content. Sample B having the highest fat content could make it a good supplement in the diet of a person suffering from diseases associated with coronary artery since vegetable fat and oil are lower in cholesterol thereby helps in reducing blood lipids. The low value of fat obtained in sample A *vitex doniana*

suggest that these leaves are poor sources of lipids, hence they could be a good diet for people suffering from obesity (Ejoh *et al*., 1996; Gazuwa and Timothy, 2019). This fat (%) also showed that genetic factor and variety of plant varies in their fat content. The *vitex doniana* that was observed its fat to be 1.7% is higher than report of Oselebe whom reported that the fat content is 1.4% after dried while fat content of *zanthoxylum zanthoxylides* has not been properly documented before now.

This result is similar to report of Nnamani, (2013) when reported the ash content of the samples to range from 8.10 to 6.30% when dried. The relatively high value of the ash content obtained on the leaves investigated is an indication that these leaves could be a good sources of mineral for human nutrition. This assertion is in consonance with the report by Fagbohun *et. al,* (2012) that high ash contnet in any food substance implies high mineral content.

High fiber in any food could play an active role in clearing of digestive tract and increase faces consistency. It also helps in reducing blood sugar and acts as a general body purifier (Emebu and Anyika, 2011).This result shows that the fibre are higher than the fibre content of *vitex doniana* and *zan thoxylum zanthoxyloides* as reported by Okporie, (2013)when reported on oven dried to ranged from 12.50 to 4.50%

The result is similar to a report of Adejumo *et. al,* (2013) whom reported the protein content of *vitex doniana* to be 8.10%, also to the report of Nnamani *et. al,* (2013) whom reported the protein content of *zanthoxylum zanthoxyloides* to be 5.12% when dried, this low carbohydrate content in sample A *vitex doniana* is similar to a report of Olujobi (2015) who reported the carbohydrate content to be 22.57%, But different with a report of Oselebe *et. al,* (2013) and Marta, Ana, Aida, Luis, Ana & *Generosa* (2019), on *zanthoxylum zanthoxyloides* whom reported the carbohydrate content to be 58.94%.

The result from *vitex doniana* is within the range of a report of Olujobi, 2015 who reported the phytate value to be 1.33 for oven dried, while that of the *zanthoxylum zanthoxyloides* has not been properly documented. The results from this study were below the established toxic level of 6% (Sobowale *et. al,* 2011).

These were similar to a report of work done by Olujobi, (2015) and Yangora and Bello (2017), on *vitex doinana*, who reported the tannin content to be 0.35mg/100g; while that of *zanthoxylum zanthoxyloides* have not been properly documented.

This result are similar to a report of Agbaire, 2011, on same green vegetables, *Talinum triangular*, *Amaranthus spinous* whom reported the oxalate content to range from 0.76 to 0.92. The oxalate content obtained are within recommended intake by FOA, WHO.

**Conclusion**

It has been observed that two lesser utilized vegetable investigated in this

study contained considerable amount of proximate constituents (moisture, fat, ash, fibre, protein and carbohydrate) and anti-nutrient (phytate, tannin and oxalate) in varying proportion. The high moisture content of the samples will encourage microbial growth, increase in the rate of enzymatic reaction hence lead to deterioration. The high fibre content of *vitex doniana* will help in reduction of blood sugar and act as a general body purifier, the high ash content on the samples is an indication that these vegetable are good source of other mineral for human consumption. The anti-nutrient factors such as phytate, tannin and oxalate were detected from the result of the analysis these were present in small quantity; these factors may not pose any serious nutritional problem in its consumption.

**Recommendation**

- Since the leaves of the lesser utilized vegetable *vitexdoniana* and *zanthoxylum zanthoxyloides* contained considerable amount of important nutrient it is suggested that they should be taken as food or added to food as a supplement as its consumption poses no danger to human health, but rather a more healthy living.
- It is also potential for income generation, poverty reduction and could help in reducing micro nutrient deficiency for a small holders farmers especially woman, children and the elderly.
- It is recommended that government and corporate bodies should embark on plantation establishment of these species for sustainable production.
- Also modern propagation techniques should be taught to all communities that produces these plants by the extension staff of the government agencies.

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