

Environmental Chemistry 2020- Comparative Assessment of Quantitative Phytochemical Contents of Leafy Vegetables Sourced from Two Major Markets in Umuahia Abia State Nigeria-Chimere Ezekwe-University of Agriculture Umudike-Nigeria

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Abstract

Leafy vegetables play an important role in the sanative and officinal needs of the people of Umuahia in Abia State Nigeria. The leafy vegetables can be cut and mashed into a liquid or added in meals for medical purposes. The comparative assessment of quantitative phytochemical contents of leafy vegetables sourced from two major markets in Umuahia, Abia State, Nigeria, was done using standard methods in triplicates. The quantitative phytochemical screening indicated that the alkaloids content of the leafy vegetables ranged from $0.63 \pm 0.02\%$ to $5.13 \pm 0.01\%$ with *Vernonia amygdalina* in Ubani recording the highest $5.13 \pm 0.01\%$ while *Gnetum africanum* in Ori-Ugba recorded the lowest $0.63 \pm 0.02\%$. There was no significant statistical variation ($p > 0.05$) between *Pterocarpus soyanxii* sourced from the two markets. The saponins content of the leafy vegetables ranged from $1.30 \pm 0.02\%$ to $9.13 \pm 0.06\%$ with *Gnetum africanum* in Ori-Ugba recording the lowest $1.30 \pm 0.02\%$ while *Pterocarpus soyanxii* also in Ori-Ugba recorded the highest $9.13 \pm 0.02\%$. There was a significant statistical variation ($p < 0.05$) in saponins content of leafy vegetables of the same species between the two markets. The flavonoids level of the leafy vegetables ranged from $2.51 \pm 0.01\%$ to $7.79 \pm 0.03\%$ with *Pterocarpus soyanxii* in Ori-Ugba recording the lowest $2.51 \pm 0.01\%$ and *Talinum triangulare* also in Ori-Ugba recording the highest $7.79 \pm 0.03\%$. There was a significant statistical variation ($p < 0.05$) in flavonoids content of the leafy vegetables of the same species from the two markets. The tannins levels ranged from $0.05 \pm 0.01\%$ to $0.14 \pm 0.01\%$ with *Telfairia occidentalis* in Ori-Ugba market recording the lowest $0.05 \pm 0.00\%$ while *Pterocarpus soyanxii* in Ubani market recorded the highest $0.14 \pm 0.01\%$. The tannins levels obtained in this study were generally low, although the tannins levels in Ori-Ugba market were much lower. There was no significant statistical variation ($p > 0.05$) in tannins content between *Vernonia amygdalina* and *Talinum triangulare* samples in the two markets. The phenols levels ranged from $0.05 \pm 0.00\%$ to $0.26 \pm 0.00\%$ with *Talinum triangulare* and *Pterocarpus soyanxii* from Ori-Ugba market recording the lowest while *Talinum triangulare* in Ubani market recorded the highest $0.26 \pm 0.00\%$. There was a significant statistical variation ($p < 0.05$) in phenols content of

leafy vegetables of the same species in the two markets. The phytochemical analysis carried out in this research have revealed that the leafy vegetables samples sourced from Ori-Ugba and Ubani market have appreciable amounts of phytochemicals which can serve the therapeutic needs of the residents of Umuahia. It is hereby advised that the steady intake of these leafy vegetables be encouraged.

INTRODUCTION

Throughout the past 10 years, the general idea of promoting health using vegetables and fruits has become a rightful way of the preservation of mental and physical health by preventing or treating illness (Nielsen, 2010). Vegetables are crucial constituents of human diets that have nutrients which are needed in large quantities and element that occurs at very small quantities in the body but is nonetheless important for many biological processes (Abdullah and Chmielnicka, 1990). Vegetables have appearances that are green and leaf-like bearing edible roots, stems and leaves (Sharma, 2004). The basic components in vegetable leaves gives alkalizing results and also neutralizes the acidity caused by foods that have animal origin (Genderd, 1994). Vegetables provide good source of carotene, ascorbic acid, riboflavin, folic acid and minerals like calcium, iron and phosphorous (Nnam et al., 2012). Vegetables are foods that gives crucial protection and are good for the sustenance of good health and keeping diseases away (Kubmarawa et al., 2009). Phytochemicals can be defined as naturally occurring compounds in plants. Phytochemicals are responsible for the colour, flavour and smell of plants. Also, they help the plant fight against diseases. Therapeutic importance of phytochemicals to human health and fighting of diseases have been studied (Okwu, 2004). Phytochemicals are also non-nutrient, bioactive plant compounds in vegetables, fruits, grains and other plant products. They have been associated with cutting the risk of major degenerative diseases (Liu, 2004). Phytochemicals, which are seen in large amounts in vegetables and fruits, are involved in this protective effect (Sundarrayanan et al., 2011). This research work aims to compare and assess the quantitative phytochemical contents of some selected leafy vegetables sold at Ori-Ugba Market and Ubani Markets in Umuahia, Abia State, Nigeria.

MATERIALS AND METHODS

Reagents and glassware: Reagents used for this work are analytical (AnalaR) grade. Glassware and plastic containers used were thoroughly washed with detergent solution soaked overnight with 20 % (v/v) HNO₃ and then rinsed with tap water, distilled water and finally deionized water prior to use.

Samples collection: Fresh samples of the leafy vegetables; *Telfairia occidentalis* (fluted pumpkin), *Vernonia amygdalina* (bitter leaf), *Gnetum africanum* (okazi), *Talinum triangulare* (waterleaf), *Pterocarpus soyansii* (oha) were procured from Ori-Ugba and Ubani market in Umuahia North Local Government Area of Abia State, Nigeria. Composite sampling method (Naser et al., 2009) in which three subsamples of each sample were combined into a composite sample was used for sample collection. Collection of samples was done monthly over a 3-month period (July-September 2016). The fresh samples collected were put into polythene bags and were taken to the Taxonomy Unit, Department of Plant Science and Biotechnology, Michael Okpara University of Agriculture Umudike, where a Taxonomist identified the *Telfairia occidentalis* (fluted pumpkin), *Vernonia amygdalina* (bitter leaf), *Gnetum africanum* (okazi), *Talinum triangulare* (waterleaf) and *Pterocarpus soyansii* (oha).

Sample pre-treatment and analysis: The fresh leafy vegetables were removed from their stalks, and then washed with clean tap water and finally with deionised water to remove dust particles. They were spread on a clean plastic tray and air-dried overnight at room temperature to remove residual moisture. The samples were later oven dried on a paper envelope (Abuye et al., 2003) at 58°C for 24-48 hrs depending on the sample size for complete dryness. The dry vegetable samples were pulverised with a blender (Panasonic MX-337) into fine powdery form. Each of the samples was stored in well-labelled plastic containers for analysis. The dried powdered samples were used for the analyses. The quantitative phytochemical analyses were done in the Chemistry Laboratory of Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria. Determination of quantitative phytochemical contents: The saponin and flavonoids content of the samples were determined by double extraction gravimetric method (Harborne, 1973). The Folin-Denis spectrophotometric method (Pearson, 1976) was used for tannin and phenol content determination. The gravimetric method (Harborne, 1984) was used for alkaloids determination.

Statistical analysis: The statistical analysis was done using Statistical Package for the Social Sciences (SPSS). Mean concentrations and Standard Error were calculated for each parameter. The results were subjected to one-way Analysis of Variance (ANOVA) at 95% confidence level to analyze the data and Duncan Multiple Range Comparism was used to compare

and test the significant difference in their means. Alphabets (a, b, c, d ...) were used to indicate the differences. The assumption was that there were no significant differences among them when the statistical comparison gives $p > 0.05$. Whenever a significance difference exists, the means were compared at $p < 0.05$ significance level.

RESULTS AND DISCUSSION

The phytochemical composition of *Talinum triangulare*, *Telfairia occidentalis*, *Vernonia amygdalina*, *Gnetum africanum* and *Pterocarpus soyansii* obtained from Ori-Ugba and Ubani market are as shown in tables 1 and 2 respectively, and these phytochemicals include alkaloids, saponins, flavonoids, tannins and phenols. The results from tables 1 and 2 shows that the leafy vegetables have considerable quantities of these phytochemicals and the medicinal and sanative importance of plants and their products depends on the presence of these phytochemicals in them (Edeoga et al., 2005; Bishnu et al., 2009). Alkaloids content of the leafy vegetables ranged from 0.63±0.02% to 5.13±0.01% with *Vernonia amygdalina* in Ubani recording the highest 5.13±0.01% while *Gnetum africanum* in Ori-Ugba recorded the lowest 0.63±0.02%. The alkaloids range of 0.63±0.02% to 5.13±0.01% recorded in this work is higher than the range (1.21% to 2.42%) Osuagwu and Eme (2013) reported for *D. guineense*, *V. doniana* and *D. tripetala* leaves. There was no significant statistical variation ($p > 0.05$) between *Pterocarpus soyansii* samples sourced from the two markets. The saponins content of the leafy vegetables ranged from 1.30±0.02% to 9.13±0.06% with *Gnetum africanum* in Ori-Ugba recording the lowest 1.30±0.02% while *Pterocarpus soyansii* also in Ori-Ugba recorded the highest 9.13±0.02%. The saponins range obtained in this study were higher than the range Osuagwu and Eme (2013) recorded for *D. guineense*, *V. doniana* and *D. tripetala* leaves. Whitney and Relfe (2005) in their study reported that tannins and saponins have the potentiality to reduce serum cholesterol and also fight against cancer when their concentrations are low in the body. There was a significant statistical variation ($p < 0.05$) in saponins content of leafy vegetables of the same species between the two markets. The flavonoids level of the leafy vegetables ranged from 2.51±0.01% to 7.79±0.03% with *Pterocarpus soyansii* in Ori-Ugba recording the lowest 2.51±0.01% and *Talinum triangulare* also in Ori Ugba recording the highest 7.79±0.03%. The flavonoids range obtained in this study is higher than the range (0.50% to 0.18%) reported by Osuagwu and Eme (2013) for *D. guineense*, *V. doniana* and *D. tripetala* leaves. There was a significant statistical variation ($p < 0.05$) in flavonoids content of the leafy vegetables of the same species between the two markets. Nnam (2011) reported that flavonoids have antioxidant attributes that protects the body against cardiovascular diseases and some forms of cancer. The

tannins levels ranged from 0.05±0.01% to 0.14±0.01% with *Telfairia occidentalis* in Orié-Ugba market recording the lowest 0.05±0.00% while *Pterocarpus soyanxii* in Ubani market recorded the highest 0.14±0.01%. The tannins levels obtained in this study were generally low, although the tannins levels in Orié-Ugba market were much lower. Osuagwu and Eme (2013) also reported a low range of 0.50% to 0.169% for *D. guineense*, *V. doniana* and *D. tripetala* leaves. There was no significant statistical variation ($p > 0.05$) in tannins content between *Vernonia amygdalina* and *Talinum triangulare* samples in the two markets. The presence of tannins in these leafy vegetables suggested that the astringent properties help in the wound healing and inflamed mucus membrane (Farquar, 1996). The phenols levels ranged from 0.05±0.00% to 0.26±0.00% with *Talinum triangulare* and *Pterocarpus soyanxii* from Orié-Ugba market recording the lowest while *Talinum triangulare* in Ubani market recorded the highest 0.26±0.00%. The phenols levels in the two markets are low and not comparable to the range (0.08% to 0.14%) Osuagwu and Eme (2013) reported for *D. guineense*, *V. doniana* and *D. tripetala* leaves. There was a significant statistical variation ($p < 0.05$) in phenols content of leafy vegetables of the same species in the two markets. The largest and most important groups of secondary metabolites and bioactive compounds in plants are the phenolic compounds (Kim et al., 2003; Sigh et al., 2007). The antioxidant properties of phenols, which help to prevent oxidative damage to biomolecules like DNA, lipids, and protein, play great part in the prevention of chronic diseases such as cancer and cardiovascular diseases (Oyedemi et al., 2012).

Table 1. Mean (\pm SE) phytochemical compositions (%) of leafy vegetable samples obtained from Orié-Ugba market.

Sample	Alkaloids	Saponins	Flavonoids	Tannins	Phenols
<i>Vernonia amygdalina</i> (bitter leaf)	3.94±0.03 ^b	5.28±0.03 ^f	3.34±0.03 ^f	0.08±0.00 ^{bc}	0.10±0.00 ^e
<i>Talinum triangulare</i> (waterleaf)	1.38±0.03 ^f	4.55±0.03 ^g	7.79±0.03 ^a	0.10±0.00 ^{abc}	0.05±0.00 ⁱ

<i>Telfairia occidentalis</i> (fluted pumpkin)	2.88±0.01 ^d	6.20±0.11 ^e	5.47±0.03 ^c	0.05±0.01 ^c	0.07±0.00 ^g
<i>Gnetum africanum</i> (Okazi)	0.63±0.02 ^g	1.30±0.02 ⁱ	4.85±0.02 ^d	0.08±0.00 ^{bc}	0.09±0.00 ^f
<i>Pterocarpus soyanxii</i> (Oha)	1.45±0.03 ^{ef}	9.13±0.06 ^a	2.51±0.01 ^h	0.07±0.00 ^{bc}	0.05±0.00 ⁱ

Values are means of three replicates \pm SE. Superscripts with same alphabetical indications showed no significant statistical variation ($p > 0.05$) while superscripts with different alphabetical indications showed there is significant statistical variation ($p < 0.05$).

Table 2. Mean (\pm SE) phytochemical compositions (%) of leafy vegetable samples obtained from Ubani market.

Sample	Alkaloids	Saponins	Flavonoids	Tannins	Phenols
<i>Vernonia amygdalina</i> (bitter leaf)	5.17±0.03 ^a	8.44±0.06 ^b	3.81±0.11 ^e	0.11±0.05 ^{ab}	0.14±0.00 ^d
<i>Talinum triangulare</i>	5.13±0.01 ^a	7.50±0.02 ^c	7.21±0.14 ^b	0.10±0.00 ^{ab}	0.26±0.00 ^a

(waterleaf)					
<i>Telfairia occidentalis</i> (fluted pumpkin)	3.77± 0.02 ^c	3.90± 0.04 ^h	3.14± 0.01 ^g	0.10±0 .00 ^{ab}	0.15± 0.00 ^c
<i>Gnetum africanum</i> (Okazi)	3.91± 0.03 ^b	6.79± 0.08 ^d	3.74± 0.01 ^e	0.13±0 .01 ^a	0.25± 0.00 ^b
<i>Pterocarpus soyauxii</i>	1.47± 0.03 ^f	3.57± 0.03 ^h	3.87± 0.03 ^e	0.14±0 .01 ^a	0.07± 0.00 ^h

i (Oha)

Values are means of three replicates ± SE. Superscripts with same alphabetical indications showed no significant statistical variation ($p > 0.05$) while superscripts with different alphabetical indications showed there is significant statistical variation ($p < 0.05$).

CONCLUSION

The selected leafy vegetables are commonly eaten in Umuahia, Abia State, and sometimes consumed in their raw state for medicinal purposes. This research work showed that the leafy vegetables varied in their phytochemical contents. The presence of some biologically active non-nutritional components in these leafy vegetables can serve as a potential source of useful drugs.