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Effect of Processing Methods on the Nutritional and Phytochemical Properties of Scent Leaf in Anambra State, Nigeria

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***Abstract*: The study examined the effect of processing methods on the nutritional and phytochemical properties of scent leaf. Scent leaf, a popular aromatic herb, was subjected to different processing methods (fresh, sundried, oven dried, and blanched/oven dried) to assess their impact on its nutritional and phytochemical. The results revealed significant variations in various parameters among the processed scent leaves. Nutritional parameters, including moisture, crude fats, crude proteins, crude fiber, total ash, carbohydrates and energy content, were analyzed. The range of values for moisture content, crude protein, crude fat, crude fibre, total ash, carbohydrate and energy contents were 7.70-62.47%, 9.80-13.43%, 1.50 -2.00%, 8.57-11.86%, 6.88-12.50%, 10.88-53.29% and 74.54-242.77kcal. The Phytochemical components (phytates, tannins, and total phenols) also varied significantly among the processed scent leaves. Phytates were highest in fresh leaves (6.12mg/100g) and lowest in blanched/oven-dried leaves (3.91mg/100g). Tannins were highest in fresh leaves (0.14mg/100g) and lowest in sundried leaves (0.10mg/100g). Total phenols were most abundant in fresh leaves (7.36mg/ml) and least in blanched/oven-dried leaves (2.10mg/ml). In conclusion, the choice of processing method significantly affects the nutritional and phytochemical content of the scent leaves, which may have implications for their use in culinary and medicinal applications. These findings provide valuable insights for the optimal utilization of scent leaf in various preparations.**

***Keywords*: analysis, nutritional, phytochemical, processing, scent leaf.**

1. Introduction

Scent leaf (*Ocimum gratissimum*) belongs to the family leguminocaeae, commonly known as "*alfavaca*". It is naturally used in the treatment of different diseases, which include upper respiratory tract infections, diarrhea, headache, conjunctivitis, skin disease, pneumonia, tooth and gum disorder, fever and as mosquito repellants. *O. gratissimum* is found in the tropical and warm temperature regions such as India and Nigeria [1]. Some of the vernacular names in Nigeria include: (Ncho-anwu, Ahuji) Igbo, (Efinrin,)Yoruba, (Aramogbo) Edo and (Daidoya) Hausa [2]. Ocimum canum Sims is a semi-woody plant of about 40 cm high that belongs to the family of Lamiaceae. It is an aromatic plant and native to tropical Africa [3]. The extract from the leaves of *O. gratissimum* possesses good antioxidant potential, which may be attributed to its phytochemical constituents [4].

The nutritional importance of *Ocimum gratissimum* centres on its usefulness as a seasoning because of its aromatic flavor. In folk medicine, *Ocimum gratissimum* is extensively used throughout West Africa as a febrifuge, anti-malarial, anti-convulsant and against cough. The volatile aromatic oil from the leaves consists mainly of thymol (32-65%) and eugenol. It also contains xanthones, terpenes and lactone [5]. In Nigeria, the leaf is used as a condiment in the preparation of dishes such as '*pepper soup*', '*jollof rice*', and vegetable soups. It was initially used in the preparation of these dishes to enhance their flavour. However, their usage in the preparation of these dishes is gaining increased acceptance due to the perceived nutraceutical benefit [6]. In Nigeria, leafy vegetables are hardly processed, may be due to the general lack of basic preservation facilities for freezing, canning or dehydration. Green leafy vegetables are highly perishable with shelf life of only few days owing to higher amount of moisture. Most of the harvested green vegetables gets rotten and spoilt or becomes inedible rendering wastage of a huge amount of nutritious products. Drying is one of the common traditional methods of preservation, which converts the vegetable into lightweight easily transportable and storage product. The advantage of this method is that the vegetable can be easily converted into fresh like form by rehydrating it and can be used throughout the year. In addition to increasing variety in the menu, reducing losses, labor and storage space, dehydrated vegetables are simple to use and have longer shelf life than fresh vegetables along with concentration of nutrients [7]. The quantity of the dehydrated product in terms of rehydration ratio, color and flavor retention depends on the pretreatments and methods of drying. In the process of dehydration, heat application result in change in the quality [8]. In this study, scent leaves were processed with three different methods: the 1st method was the conventional method which is the sun drying, the second method was the oven drying of the leaves while the last method is the method of blanching before oven drying. The fresh leaves were also analyzed. The effect of these processing methods on the proximate composition and phytochemical content of scent leaf vegetables were evaluated.

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2. Materials and Methods

A. Samples Collection

Fresh Scent leaves were obtained from a vegetable garden in 'Amaokpala'' in Orumba North LGA, Anambra state, in South Eastern Nigeria.

B. Sample Preparation

Fresh scent leaves (*Ocimum gratissimum*) were manually separately from the stalk and rinsed with deionized water and the residual moisture evaporated at room temperature. A portion of the fresh samples was analyzed on fresh basis. Second portion of the fresh scent leaves was sundried until constant weight was obtained (12h), third portion was oven dried at 55ºC until a constant weight was obtained while the last portion was blanched at 60ºC for 5 min before oven drying (at 55ºC until a constant weight was obtained). The dried leaves were pulverized using Thomas Willey milling machine into fine powder and sieved through 2mm mesh sieve to produce fine dried sample. The dried ground sample were stored in airtight containers at room temperature until needed for further analysis.

C. Proximate Composition Determination

The moisture, crude protein (N × 6.25), crude fat and crude fibre were obtained using standard methods [9]. Carbohydrate was obtained by difference.

D. Moisture Content Determination

Two grams of each sample was weighed into dried weighed crucible and dried in an oven at 105^{O}C for 3h. The dried samples were put into desiccators, cooled and reweighed. The process was repeated until constant weight was obtained. The difference in weight was calculated as the percentage moisture of the original sample.

$$\text{Percentage (\%) moisture} = \frac{W_2 - W_1}{W_2 - W_3} \times 100$$

Where,

W_1 = Initial weight of empty dish
W_2 = Weight of dish and undried sample
W_3 = Weight of dish and dried sample

E. Ash Content Determination

Two grains of each sample was weighed into a crucible, dried in an oven for 3h at 100^{O}C, then transferred into a muffle furnace at 550^{O}C. Heating continued and was stopped when the material turned ashy in colour. The dish and ash were reweighed after cooling in a desiccators at room temperature. The weight of the residual ash was calculated.

$$\text{Percentage (\%) ash} = \frac{\text{Weight of Ash}}{\text{Weight of original sample}} \times 100$$

F. Fat Content Determination

Two grams of each sample was loosely wrapped with filter paper and with 120ml of petroleum ether. The fat content was extracted by soxhlet extraction technique for 5h. The percentage (%) oil content was calculated as follows:

$$\text{Percentage (\%) oil content} = \frac{W_2 - W_1}{W_3} \times 100$$

Where,

W_1 = Weight of empty extraction flask
W_2 = Weight of the flask and oil extracted
W_3 = Weight of the sample

G. Crude Fibre Determination

Two gram (2g) sample and 1g asbestos were put into 200ml of 1.25% of H_2SO_4 in a flask and boiled for 30min. The mixture was poured unto a Buchner funnel fitted with cheese cloth, secured with a rubber band and allowed to filer. The residue was transferred into 200ml boiled NaOH and boiling continued for 30mins, and the mixture was filtered using the Buchner funnel. The residue was washed with alcohol twice, followed by thrice washing with petroleum ether. The residue was then transferred to a weighed, clean, dry crucible and dried in an oven to constant weight. The percentage (%) crude fibre of the samples was calculated as:

$$\text{Percentage (\%) crude fibre} = \frac{W_1 - W_2}{W_3} \times 100$$

Where,

W_1 = Weight of sample before incineration
W_2 = Weight of sample after incineration
W_3 = Weight of original sample

H. Crude Protein Determination

Two grams of each sample digested using 10ml of Con. H_2SO_4 and one tablespoon of selenium catalyst in along necked digestion tube. Heating was done in a fume chamber. 10ml of the digest was mixed with equal volume of 45% of NaOH solution and poured into a kjeldahl distillation apparatus and the mixture was distilled and the distillate was collected into 4% boric acid solution containing 3 drops of methyl red indicator. Titration was done using 50ml of the distillate. The nitrogen content was calculated and multiplied with 6.25 factor to obtain the crude protein content.

$$\text{Percentage (\%) Nitrogen} = \frac{(100 \times N \times 14 \times VF)T}{100 \times V_a}$$

Where,

N = Normality of Titre (0.IN)
VF = Total volume of digest: (100ml)
T = Titre value
V_a = Aliquot volume distilled

I. Carbohydrate Content Determination

The carbohydrate was calculated as: weight by difference between 100 and the summation of other proximate parameters:

$$\text{NFE} = 100 - (M + P + F_1 + A + F_2)$$

Where,

M = Moisture,
P = Protein,
F_1= Fat,
A = Ash,
F_2= Crude Fibre.

J. Phytochemical Analysis

1) Determination of Phytates

The phytate contents of the sample were determined [10]. Five gram of each sample was soaked in 100ml of 2% HCl in a 250ml conical flask, and filtered after 5h soaking time. 25ml of the filtrate was mixed with 50ml, 0.3% Potassium thiocyanate solution (as indicator) all in a 250ml beaker. The mixture was titrated against standard $FeCl_3$ solution until slightly brownish yellow colour persisted for 5min.

$$\% \text{ Phytate (mg/100g)} = \frac{Titre \times 0.064 \times 100}{Weight\ of\ sample}$$

2) Determination of Tannin

Tannin was determined using the standard [10]. Two grams of the dried sample was boiled in 300ml distilled water, cooled, diluted and filtered through a non-absorbent cotton wool. 25ml of the infusion was titrated with 0.1N $KMnO_4$ (which was standardized against 0.1N oxalic acid), till there was a colour change. Tannin was calculated as follows: Tannin content (mg/100g) = titre X 0.0066235.

3) Determination of Total phenolic content

Total phenolic content is analyzed using the Folin-Ciocalteu colorimetric method [10]. An aliquot of 0.3ml of the scent leaf samples were mixed with Folin-Ciocalteu phenol reagent (2.25. mL). After 5 min, 6% of sodium carbonate (2.25mL) was added and the mixture was allowed to stand for at room temperature for 90 min. The absorbance of the mixture was measured at 725nm. Standard calibration curve for gallic acid in the range of 0-200 1g/mL was prepared in the same manner and results were expressed as mg Gallic Acid Equivalent (GAE) per gram of extract.

TPC = C*V/W

C= Concentration of gallic acid calculated from calibration curve in mg/ml
V=Volume of extract in ml
W=Weight of plant ethanolic extract in g

4) Statistical analysis

Data obtained were analyzed by one way analysis of variance (ANOVA) [11] statistical procedure and significance was accepted at 0.05 level of probability. Duncan range test was used to determine the difference among means.

3. Results and Discussion

Table 1 revealed that the moisture of the fresh, sun dried, oven dried and blanched/oven dried scent leaves differed significantly ($p<0.05$). The moisture content ranged from 7.70 to 62.47. The low moisture content of samples SO2, BO3 and LO4 would hinder the growth of microorganisms and the storage life would be high (Adeyeye and Ayejuyo,1994)[12]. The crude protein content of the scent leaf samples are: 9.80%, 13.01% and 13.43% and 12.83 % for samples FO1,, SO2,BO3 and LO4 respectively and they compare favourably with *Heinsia crinita* (14.7%), but they are relatively low when compared with *Amaranthus caudatus* (20.59%), *Piper Guineeses* (29.78%) and *Talinum triangulare* (31.00%) (Akindahunsi and Salawu, 2005)[13].The value of the crude fat for the scent leaf samples were low when compared to those of *Talinum triangulare* (5.90%), *Baseila alba* (8.71%), *Amaranthus hybridus* (4.80%), *Calchorus africanum* (4.20%) [13]. A diet providing 1-2% of its caloric of energy as fat is said to be sufficient to human beings as excess fat consumption is implicated in certain cardiovascular disorders such as atherosclerosis, cancer and aging [14]. The crude fibre content of 8.57%, 9.70% ,11.80% and 11.86% for samples FO1, SO2, BO3 and LO4 respectively and were high compared with *Talinum triangulare* (6.20%), *Piper guineeses* (6.40%), *Corchorus olitorius* (7.0%) and bitter leaves (*Vernonia amygdalina*) (6.5%) [13]. Generally dietary fibre helps in digestion and functions the body to slow down the rate of glucose absorption into the blood stream thereby reducing the risk of hyperglycemia, the levels of plasma choresterol and hence preventing colon cancer and cardiovascular diseases [15]. Non-starchy vegetables are the richest sources of dietary fibre [16] and are employed in the treatment of diseases such as obesity, diabetes, cancer and gastrointestinal disorders [8]. The values for ash content were 6.88 %, 12.50 %, 10.36 % and 10.00 % for samples FO1, SO2, BO3 and LO4 respectively. The ash content of the leaves was lower than that of some leafy

Table 1
Effect of processing methods on the nutritional and phytochemical content of scent leaf

Parameters	FO1	SO2	BO3	LO4
Moisture (%)	62.47^{a}±0.02	7.70^{d}±0.01	10.15^{c}±0.03	10.36^{b}±0.01
Protein (%)	9.80^{d}±0.01	13.01^{b}±0.05	13.43^{a}±0.03	12.83^{c}±0.01
Fat (%)	1.40^{d}±0.01	1.50^{c}±0.02	2.00^{a}±0.00	1.70^{b}±0.02
Fibre (%)	8.57^{c}±0.25	9.70^{b}±0.01	11.80^{a}±0.01	11.86^{a}±0.01
Ash (%)	6.88^{d}±0.01	12.50^{a}±0.02	10.36^{b}±0.00	10.00^{c}±0.01
Carbohydrates (%)	10.88^{d}±0.01	55.60^{a}±0.01	52.34^{c}±0.01	53.29^{b}±0.01
Energy(kcal/100g)	74.54^{d}±0.03	242.77^{a}±0.02	236.29^{b}±0.02	235.71^{c} ±0.01
Phytochemical factors				
Phytates (mg/100g)	6.12^{a}±0.01	5.70^{b}±0.01	4.70c±0.02	3.91d±0.01
Tannins (mg/100g)	0.10^{d}±0.00	0.12^{c}±0.01	0.14^{a}±0.00	0.13^{b}±0.01
Total Phenols (mg/ml)	7.36^{a}±0.01	6.31^{b}±0.01	3.30^{c}±0.02	2.10^{d}±0.02

Key: FO1 = Fresh scent leaf, SO2 = Sundried scent leaves, BO3 = oven dried scent leaf, LO4 = blanched/oven dried scent leaf. Mean values with the same superscripts within the row are not significantly different from each other

vegetables commonly consumed in Nigeria such as waterleaf (*Talinum triangulare*) (20.05%) [13]. The results obtained from the proximate analysis of the scent leaf samples establishes that they can be ranked as carbohydrate and energy rich leaves due to their relatively high carbohydrate and energy content when they are dried.The phytochemicals (phytate and polypehnols) of the fresh samples were higher than those of the sun and the oven-dried samples. This confirms the report of [8] that fresh vegetables are better sources of phytochemicals as against the sun and the shade dried samples.

4. Conclusion

From the result of proximate analysis, it is quite interesting that *ocimum gratissimum* that was dried in the oven at low temperature had more protein content while the blanched oven dried samples had higher crude fibre content. The choice of processing method can significantly impact the phytochemical composition of the leaves, which, in turn, can influence their nutritional value, sensory characteristics, and potential health benefits. In conclusion, the study revealed that processing methods influenced the nutrient and phytochemical composition of scent leaves.

References

[1] R. N. Okigbo and O. U. Ogbonnanya, "Antifungal effects of two tropical plants extracts Ocimum gratissimum and Afromaomum melegueta on post-harvest yam Discorea spp rot," *Afr. J. Biotechnol*., vol. 5, no. 9, pp. 727-731, 2006.

[2] I. D. Effraim, H. A. Salami, and T. S. Osewa, "The effect of aqueous leaf extract of Ocimum gratissimum on haematological and biochemical parameters in rabbits," *Afr. J. Biomed. Res*., pp. 175-179, 2000.

[3] J. Steel, "Perfumeros and the sacred use of fragrance in Amazonian shamanism," in The Smell Culture Reader, J. Drobnick, Ed., Berg Publishers, 2006, p. 23.

[4] A. C. Akinmoladun, E. O. Ibukun, E. Afor, E. M. Obuotor, and E. O. Farombi, "Phytochemical constituent and antioxidant activity of extract from the leaves of Ocimum gratissimum," *Sci Res Essay*, vol. 2, no. 5, pp. 163-166, 2007.

[5] P. Y. Chao, J. A. Lin, J. C. Ye, J. M. Hwang, W. J. Ting, C. Y. Huang, and J. Y. Liu, "Attenuation of oxidative stress-induced cell apoptosis in Schwann RSC96 cells by Ocimum gratissimum aqueous extract," *International Journal of Medical Sciences*, vol. 14, no. 8, pp. 764-771, 2017.

[6] J. Y. Talabi and S. A. Makanjuola, "Proximate, Phytochemical, and In Vitro Antimicrobial Properties of Dried Leaves from Ocimum gratissimum," *Prev Nutr Food Sci*, vol. 2017, no. 3, pp. 191-194, 2017.

[7] S. K. Chauhan and C. R. Sharma, "Development of instant dehydrated sagg," *Beverage and Food World*, vol. 20, no. 4, pp. 25-26, 1993.

[8] E. P. Eme-Okafor, "Effect of drying methods on the nutrient and phytochemical properties of some cultivated and wild leafy vegetables. A research project presented in partial fulfillment of the requirements for the award of Masters of science Degree in Nutrition and Dietetics, University of Nigeria, Nsukka," 2012.

[9] "Official Method of Analysis of the AOAC (W. Horwiz Editor) Eighteenth Edition," Washington D.C., Association of Official Analytical Chemists (AOAC), 2010.

[10] G. I. Onwuka, "Food Analysis and Instrumentation, Theory and Practice," Lagos: Naphthali Prints, 2018.

[11] SPSS, "SPSS Guide for Personal Computers, Version 16 Edition," 2004.

[12] E. I. Adeyeye and O. O. Ayejuyo, "Chemical composition of Cola acuminata and Garcinia kola seeds grown in Nigeria," *Int. J. Food Sci*. Nutr., vol. 45, pp. 223-230, 1994.

[13] A. A. Akindahunsi and S. O. Salawu, "Phytochemical screening and nutrient-antinutrient composition of selected tropical green leafy vegetables," *Afr. J. Biotechnol*., vol. 4, pp. 497-501, 2005.

[14] C. Agostoni, R. Riva, and M. Giovannini, "Dietary fiber in weaning foods of young children," *Pediatrics*, vol. 96, pp. 1000-1005, 1995.

[15] J. M. Lattimer and M. D. Haub, "Effects of dietary fiber and its components on metabolic health," *Nutrients*, vol. 2, no. 12, pp. 1266-1289, 2010.

[16] B. S. Antia, E. J. Akpan, P. A. Okon, and I. U. Umoren, "Nutritive and anti-nutritive evaluation of sweet potatoes (Ipomoea batatas) leaves," *Pak. J. Nutr*., vol. 5, pp. 166-168, 2006.