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Phytochemical and Nutritional Compositions of Fresh and Dry *Gongronema latifolium* Leaves: Possible Health Benefits

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Abstract
Gongronema latifolium, commonly known as *utazi*, is a tropical rainforest plant used as a spice and vegetable in traditional medicine. This study investigated the phytochemical, nutritional, and antioxidant properties of *utazi* leaves, comparing fresh and dry samples using standard analytical methods. Phytochemical analysis revealed that fresh leaves had higher alkaloid (7.40 ± 0.06mg/100g) and tannin (4.58 ± 0.09 mg/100g) concentrations compared to dry leaves (7.00 ± 0.06mg/100g and 3.24 ± 0.10mg/100g, respectively). At the same time, flavonoid levels were marginally higher in dry leaves (31.06 ± 0.17mg/100g) than in fresh leaves (30.02 ± 0.23mg/100g). The proximate analysis demonstrated that drying significantly reduced moisture content from 78.60% in fresh leaves to 13.2% in dry leaves and concentrated proteins from 2.43% to 25.98%, ash from 2.80% to 8.54%, fibre from 2.40% to 12.33%, fat from 1.20% to 1.97%, and carbohydrates from 12.57% to 45.57%. Vitamin analysis indicated slight variations in beta-carotene (478.2 mg/100g in fresh leaves compared to 477.1 mg/100g in dry leaves), vitamin C (43.68 mg/100g in fresh leaves compared to 44.27 mg/100g in dry leaves), vitamin E (0.57 mg/100g in fresh leaves compared to 0.46 mg/100g in dry leaves), and vitamin B_1 (0.29 mg/100g in fresh leaves compared to 0.24 mg/100g in dry leaves). The study underscored *utazi*'s potential as a functional food rich in bioactive compounds, with drying enhancing its nutritional content by concentrating key nutrients. These findings provide a basis for the culinary and medicinal applications of *utazi*, highlighting its value in traditional medicine and its potential as a health-promoting ingredient.

Keywords: Gongronema latifolium (utazi), phytochemicals, proximate composition, vitamin content, dry, fresh

Introduction

Medicinal plants have been used for centuries to prevent and cure diseases, with a significant portion of the world's population still relying on traditional or herbal medicine for treatment. These plants have been the basis of treatment for various diseases across cultures and continents (Fitzgerald *et al*., 2020). The medicinal value of plants lies in the chemical substances they contain, which can produce a definite physiological action on the human body. Medicinal plants are rich sources of ingredients that can be used in drug development and synthesis. They are important sources of drugs for treating several ailments and can be used alone or combined with other plants. Traditional medicinal plant use is widespread in many countries, including China, India, Japan, Pakistan, Sri Lanka, Thailand, Ghana, and Nigeria (Parsaeimehr *et al.*, 2017). The medicinal value of medicinal plants shows great potential for the discovery and development of pharmaceuticals due to the chemical substances contained in them. Many plants have been used in traditional medicine for years, and some have been found to work effectively (Sofowora *et al.*, 2013). The term "crude drugs of natural or biological origin" describes whole plants or parts of plants with medicinal properties. Examples of medicinal plants include *Syzygium Aromaticum* (Clove), *Jasmminum Officinale* (Jasmine), *Laurus Noblis* (Bay leave), *Psidium Guajava* (Guava), *Mormodica Charantia*, *Tinospora Cadifolia* (Guduchi), and *Gongronema latifolium* (*Utazi*). These plants have been used to treat

conditions such as upset stomach, toothache, diarrhoea, malaria, and diabetes (Rasool, 2014).

Gongronema latifolium, commonly known as *Utazi* or *Arokeke*, is a tropical rainforest plant native to West Africa. It is widely used in traditional medicine and as a food ingredient in various parts of Nigeria, particularly in the southern and eastern regions. The plant is known for its rich nutritional and medicinal properties, making it a valuable resource for health and culinary purposes (Kiran *et al*., 2018). *Utazi* leaves are rich in fats, proteins, vitamins, minerals, and essential amino acids, making it a nutritious addition to soups, salads, and other dishes. The plant is a spice and vegetable in traditional dishes like *Isiewu, nkwobi, abacha*, and *ofe nsala*. Its extracts have been found to have anti-inflammatory, antifungal, and antimicrobial properties, making it a valuable remedy for various health issues (Eleyinnu, 2007). *Utazi* is used in traditional medicine to treat various health issues, and its extracts have been found to have pharmacological activities such as hypoglycaemic, hypolipidemic, and antioxidant effects (Amrelia, 2022). The plant is deeply rooted in the culture of the Igbo and other ethnic groups in Nigeria, where it is used in various traditional dishes and as a remedy for various health issues. In conclusion, *Gongronema latifolium (Utazi)* is a versatile plant with significant nutritional and medicinal properties. Its use in traditional medicine and as a food ingredient is deeply rooted in the culture of Nigeria, particularly in the southern and eastern regions. This research aimed to assess the phytochemical and nutritional composition of dried and fresh leaves of *Gongronema latifolium* (*Utazi*). This study aimed to determine the nutritional and phytochemical components of the dried and fresh *Gongronema latifolium*, a spice and vegetable commonly used in the Southern and Eastern parts of Nigeria.

Materials and Methods

Sample Collection and Identification

The leafy vegetable, *Gongronema latifolium*, was obtained from the Edim Otop market of Atimbo, Calabar Municipal, Calabar, Cross River State, Southern Nigeria. The sample was taken to the Plant and Ecological Studies Department at the University of Calabar for taxonomical identification.

Sample Preparation

The sample was sorted to remove any bad leaves. The leaves were then rinsed with distilled water to remove dirt and dust. The leaves were separated into equal quantities, A and B. Quantity A was sun-dried for 7 days. Quantity B was kept fresh under controlled conditions to prevent desiccation or moisture loss until the analysis.

Phytochemical Analysis

Phytochemicals were extracted using various solvents and methods, including methanol, ethanol, and diethyl ether. The extracts were filtered, evaporated, and weighed to determine the presence and concentration of flavonoids, saponins, phenols, alkaloids, tannins, steroids, and oxalates. Briefly, Flavonoids were extracted by taking 100g of the plant sample and mixing it with 100 ml of 80% aqueous methanol at room temperature. The solution was then filtered and evaporated to dryness. Saponins were extracted by dispersing 20g of each sample in 200 ml of 20% ethanol and heating the mixture for four hours. The mixture was filtered and re-extracted with another 200ml of 20% ethanol. Phenols were extracted by boiling the fat-free sample with 50ml of ether, followed by treatment with ammonium hydroxide and amyl alcohol. For alkaloids, 5g of the sample was extracted with 200 ml of 20% acetic acid in ethanol, filtered, and concentrated ammonium hydroxide was added until the preparation was complete. Tannins were extracted by mixing 500mg of the sample with 50ml of distilled water, filtering the mixture, and measuring absorbance after mixing with FeCl3 and potassium ferrocyanide. Steroids were extracted by taking 5g of the finely powdered sample, mixing it with 50 ml of pyridine, and incubating it with metallic copper powder. Oxalates were detected by soaking 1g of the sample in 75 ml of 1.5N H2SO4, filtering the solution, and mixing the filtrate with 0.1M KMnO4 (Offor & Uchenwoke, 2015).

Proximate Analysis

The proximate analysis included determining moisture content, ash, and fibre using the AOAC (2000) method. Protein content was determined using the Kjeldahl method, while the lipid content was determined using the Bligh & Dyer (1959) method. Carbohydrate was analysed by difference. Briefly, moisture content was calculated by drying the sample at 105°C for three hours and then reweighing it. Protein content was determined by digesting 1g of the sample with Kjeldahl catalyst and 200 ml of concentrated H2SO4 and using a specific calculation formula. Ash content was measured by heating the sample at 550°C overnight and reweighing it. Lipid content was determined gravimetrically after homogenising 20g of the sample with chloroform and methanol. Fibre content was calculated by heating the sample with 0.25M sulphuric acid, igniting it at 550°C to obtain ash, and weighing it. Carbohydrate content was calculated by subtracting the percentages of moisture, protein, fat, fibre, and ash from 100

Vitamin Analysis

Beta-carotene, Vitamins C, E, and B1 were determined using various analytical methods (Kurilich., & Juvik, 1999; Pearson D, 1975). Vitamin A was analysed using a reflux method, Vitamin C using a TCA-DNPH method, Vitamin E using a hexane/toluene extraction method, and Vitamin B1 using a potassium dichromate method. Briefly, Vitamin A was determined by mixing 5g of the sample with absolute alcohol and potassium hydroxide, boiling the mixture gently, cooling it, washing it with ether, and calculating absorbance after evaporation. Vitamin C was measured by mixing 200µl of the extracted sample with TCA and DNPH, incubating at 37°C, and reading absorbance at 520nm. Vitamin E was extracted from 300mg of the sample using ethanol and hexane/toluene mixture, and the absorbance was recorded at 295nm. Thiamine (Vitamin B1) was analysed by homogenising 5g of the sample with ethanol sodium hydroxide, filtering, developing the colour with potassium dichromate, and reading the

absorbance at 360nm.

Data analysis

Laboratory analytical results were compiled, entered into the computer, and analysed using a Microsoft Excel 2013 spreadsheet and expressed as mean ± SD.

Data availability Statement

This article contains the results supporting this study's findings. The authors can provide any additional information upon request.

Results

Phytochemical Composition of Gongronema latifolium (Utazi)

The results of the phytochemical composition are presented in Table 1. The concentrations of various phytochemicals in dry and fresh samples were analysed, revealing distinct trends in their amounts. Alkaloid content was slightly higher in fresh samples (7.40 ± 0.06) than in dry samples (7.00 ± 0.06). Similarly, tannin concentration was significantly higher in fresh samples (4.58 ± 0.09) than in dry samples (3.24 ± 0.10). Flavonoid levels exhibited an opposite trend, with a marginally higher concentration in dry samples (31.06 ± 0.17) than in fresh samples (30.02 ± 0.23). In contrast, oxalate content was higher in fresh samples (9.84 ± 0.03) relative to dry samples (9.57 ± 0.08). Phenol content showed minimal variation between dry (23.59 ± 0.27) and fresh (23.70 ± 0.25) samples, suggesting that drying have little impact on phenol levels. Saponin concentration was greater in fresh samples (19.15 ± 0.29) compared to dry samples (18.16 ± 0.23). Similarly, steroid levels were slightly higher in fresh samples (5.75 ± 0.05) than in dry samples (5.41 ± 0.05).

Proximate Composition of Gongronema latifolium (Utazi)

The proximate analysis of dry and fresh samples, as presented in Table 2, revealed distinct differences in nutrient composition. Moisture content was significantly higher in fresh samples (78.60 ± 0.24%) compared to dry samples (13.2 ± 0.21%), indicating substantial water reduction upon drying. Protein levels were markedly elevated in dry samples (25.98 ± 0.07%) versus fresh samples (2.43 ± 0.34%), reflecting a concentration effect. Similarly, ash content was greater in dry samples (8.54 ± 0.19%) than in fresh samples (2.80 ± 0.14%). Fibre content followed this trend, with dry samples containing 12.33 ± 0.42% compared to 2.40 ± 0.19% in fresh samples. Fat content was slightly higher in dry samples (1.97 ± 0.22%) than in fresh samples (1.20 ± 0.04%). The most pronounced difference was in carbohydrate content, with dry samples showing 45.57 ± 0.19% compared to 12.57 ± 0.25% in fresh samples. Overall, the drying process concentrates proteins, ash, fibre, fat, and carbohydrates by significantly reducing the moisture content.

Vitamin Composition of Gongronema latifolium (Utazi)

The vitamin analysis results are presented in Table 3; the study analysed the vitamin composition of a specific food item in both dry and fresh forms, with measurements provided in mg per 100 grams. For beta-carotene, the content was 477.1 ± 0.58 in the dry form and 478.2 ± 0.42 in the fresh samples. Vitamin C (ascorbic acid) levels were 44.27 ± 0.41 in the dry form and 43.68 ± 0.32 in the fresh form. Vitamin E (α-tocopherol) was found to be 0.46 ± 0.01 in the dry samples and 0.57 ± 0.01 in the fresh samples. Vitamin B1 (thiamine) content was 0.24 ± 0.06 and 0.29 ± 0.06 in the dry and fresh samples.

Discussion

Phytochemicals are natural compounds in plants that offer health benefits beyond basic nutrition. Over 10,000 types influence colour, flavour, and aroma. Phytochemicals are linked to lower rates of cancer and heart disease, found in fruits, veggies, whole grains, nuts, seeds, and legumes. Their antioxidant properties combat free radicals while exhibiting antimicrobial, anti-inflammatory, and other health-promoting effects. Though lacking precise dietary recommendations, experts advise a diverse, colourful diet to maximise phytochemical intake and reap numerous benefits (Park, 2023).

The phytochemical analysis of fresh and dry *utazi* (*Gongronema latifolium*) leaves revealed several key findings. Alkaloid content was slightly higher in fresh leaves compared to dry leaves. Similarly, tannin concentration was significantly higher in fresh leaves than in dry leaves. In contrast, flavonoid levels were marginally higher in dry leaves than in fresh leaves. These findings are consistent with other studies investigating the phytochemical composition of *Gongronema latifolium* leaves. For instance, Osuagwu *et al*. (2013) reported higher alkaloid content (10%) in fresh leaves compared to dried samples. Similarly, Egbung *et al*. (2011) observed higher concentrations of flavonoids, alkaloids, hydrogen cyanide, and tannins in root extracts of *Gongronema latifolium* than in stem extracts in their study. The variations in phytochemical levels between fresh and dry leaves can be attributed to several factors, such as the drying process, storage conditions, and the inherent variability in the plant's chemical composition. Drying can affect the stability and concentration of certain phytochemicals, leading to either an increase or decrease in their levels. The findings highlight the importance of considering the processing method and its impact on the phytochemical composition when utilising *Gongronema latifolium* for various applications, such as in traditional medicine, food preparation, and dietary supplements.

From the results, alkaloids, tannins, flavonoids, oxalates, phenols, saponins, and steroids were detected in higher amounts in the fresh *Gongronema latifolium* sample than in the dry sample. This connotes that the fresh Gongronema latifolium (utazi) sample is a richer source of secondary metabolites of medicinal importance. This result is in agreement with the review and reports of Balogun *et al*., (2016) and Offor and Uchenwoke (2015), who reported that the phytochemical analysis of *Gongronema latifolium*

(*utazi*) showed the presence of flavonoid, alkaloid, saponin, steroid, oxalate, tannin and phenols among others; indicating that *utazi* is a prime remedy for certain ailments and disorders.

The proximate analysis of fresh and dry *Gongronema latifolium* (*utazi*) has shown that the leaves are a good source of moisture, protein, fibre, carbohydrates, considerable amounts of ash, and low fat. The fresh *Utazi* leaves exhibited a moisture content of 78.60 ± 0.24%, significantly reduced to 13.2 ± 0.21% in the dry samples. This substantial reduction in moisture content upon drying is consistent with studies by Morris *et al*. (2004), who noted that drying leads to an increased concentration of nutrients in plant produce. The high moisture content in fresh samples suggests they have a shorter shelf life and are more prone to spoilage than their dried counterparts.

The proximate composition of dry and fresh *Utazi* leaves from this research, which was conducted in Cross River State, shows significant differences in nutrient content compared to similar publications on *Utazi* and other similar products. One notable variation is in the moisture content of fresh *Utazi* leaves, which stands at 78.60 ± 0.24%. This is higher than the 8.76-10.23% reported by Alozie *et al*. (2020) for fresh *Uziza* leaves. Conversely, the moisture content of dry *Utazi* leaves (13.2 ± 0.21%) is lower than the 3.15-5.02% reported by Alozie *et al*. (2020) for dried *Uziza* leaves.

The protein levels in dry *Utazi* leaves were significantly higher at 25.98 ± 0.07%, compared to 2.43 ± 0.34% in fresh samples. This increase in protein concentration upon drying is supported by the findings of Morris *et al*. (2004), who reported that drying enhances the concentration of crude proteins in leafy vegetables. The drying process effectively concentrates the protein content by removing moisture. Compared to similar research, the protein content of dry samples (25.98 ± 0.07%) was significantly higher than the 2.45-8.13% reported by Alozie *et al*. (2020) for dried *Uziza* leaves. Conversely, the protein content of the fresh sample (2.43 ± 0.34%) was lower than the 1.89-6.43% range reported by Alozie *et al*. (2020) for fresh *Uziza* leaves.

Ash content in dry *Utazi* leaves was measured at 8.54 ± 0.19%, a significant increase from 2.80 ± 0.14% in fresh samples. This increase aligns with the studies by Alobi *et al*. (2012), and Zaku *et al*. (2015), who observed higher ash content in dried *Utazi* leaves than in fresh ones. Higher ash content indicates a greater presence of mineral elements, which become more concentrated as the leaves lose moisture during drying. The fibre content in dry *Utazi* leaves was significantly higher at 12.33 ± 0.42% compared to 2.40 ± 0.19% in fresh samples. This trend is consistent with findings by Uzodinma and Amie (2016), who also reported higher fibre content in dried *Utazi* leaves. The drying process enhances the fibre concentration, making the dried leaves a better source of dietary fibre than the fresh ones. The fat content in dry *Utazi* leaves was slightly higher at 1.97 ± 0.22% compared to 1.20 ± 0.04% in fresh samples. This modest fat content increase is supported by Alakali *et al*. (2016), who noted that drying can lead to a slight increase in fat content in leafy vegetables. However, the minor increase indicates that the drying process marginally affects fat concentration.

The carbohydrate content in dry *Utazi* leaves was significantly higher at 45.57 ± 0.19% compared to 12.57 ± 0.25% in fresh samples. This substantial increase is consistent with the findings of Uzodinma and Amie (2016), who reported higher carbohydrate content in dried *Utazi* leaves. The drying process effectively concentrates carbohydrates by reducing the water content and enhancing the nutritional value of the leaves in terms of energy supply. The carbohydrate content of the dry leaves surpassed the previously reported value of 38.6% for dry kale, as documented by Kahlon, *et. al.,* (2008). Conversely, the analysis of the fresh leaves revealed a carbohydrate content of 12.57 ± 0.25%, contrasting starkly with the 58.46-66 kcal per 100 g range observed in fresh kale, as documented by Emebu and Anyika (2011). These observed disparities underscored the variances in nutrient composition inherent in *Utazi* leaves sourced from distinct origins and locales, thereby accentuating the necessity of accounting for regional factors in assessing the nutritional profile of leafy greens.

The vitamin composition of *Gongronema latifolium*, presented in this research, highlights the leaf's vitamin content in both dry and fresh forms. The findings are significant in understanding the nutritional value of *Utazi* leaves and their potential applications in human and animal nutrition. The beta-carotene content in both dry and fresh forms is remarkably consistent, with values of 477.1 ± 0.58 and 478.2 ± 0.42 mg per 100 grams, respectively. This consistency suggests that the beta-carotene content is relatively stable across different forms of the leaves. Beta-carotene is a precursor to vitamin A, crucial in maintaining healthy vision, immune function, and skin health. The vitamin C (ascorbic acid) levels in the dry and fresh forms are also comparable, with values of 44.27 ± 0.41 and 43.68 ± 0.32 mg per 100 grams, respectively. Vitamin C is essential for immune function, collagen synthesis, and iron absorption. Its consistent presence in both forms of

the leaves underscores its importance in the overall nutritional profile of *Utazi*.

Vitamin E (α-tocopherol) levels are significantly higher in the fresh samples, with values of 0.57 ± 0.01 compared to 0.46 ± 0.01 in the dry samples. Vitamin E is a powerful antioxidant that protects cells from damage and supports skin health. The higher levels in fresh samples may indicate that the vitamin E content is more susceptible to degradation during drying processes. The vitamin B1 (thiamine) content is relatively lower, with values of 0.24 ± 0.06 and 0.29 ± 0.06 mg per 100 grams in the dry and fresh samples, respectively. Thiamine is essential for energy production and nerve function. The slight increase in fresh samples may suggest that the drying process can affect the thiamine content, but further research is needed to confirm this. These findings are consistent with previous research on the vitamin composition of *Utazi* leaves. For instance, a study published in the Journal of Medical and Medicinal Sciences reported high levels of vitamins A and C in the twig extract of *Gongronema latifolium*. In contrast, the root extract contained significant amounts of flavonoids, alkaloids, and hydrocyanide. Another study published in the Journal of Pharmacy and Bioresources found that the leaves of *Gongronema latifolium* were rich in protein, minerals, and vitamins, making them a valuable source of nutrition in traditional medicine. The consistent presence of beta-carotene and vitamin C in both dry and fresh forms underscores their importance in the overall nutritional value of *Utazi*. The higher levels of vitamin E in fresh samples suggest that the drying process may affect this antioxidant. Further research is needed to fully understand the effects of processing on the vitamin content of *Utazi* leaves and to explore their potential applications in human and animal nutrition.

Conclusion

From the research, it can be concluded that the fresh leaves of *Gongronema Latifolium* (*utazi*) possess high amounts of bioactive compounds, which determine its physiological properties and medicinal value, and nutrients qualify it as a complementary diet for healthy living. Hence, they are recommended to be more preferred for consumption or use as they contain phytochemicals, micronutrients and macronutrients that play key metabolic roles and serve pharmaceutical importance in increased amounts compared to dry leaves

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References

Adeniran, A. A., Adeyanju, E. and Okeke, N. K. (2022). Anatomical characterization and physicochemical standardization of *Gongronema Latifolium* benth. (apocynaceae). *Journal of Bharmacy and Bioresources*, 19 (1): 16-23

Adeyeye, E. I. and Olaleye, A. A. (2020). Proximate and mineral composition analysis of the leaves of *Gongronema Latifolium* and *Piper Guinees*. *Dutse Journal of Pure and Applied Sciences*, 6 (1): 60-65

Alakali, J.S., Ismaila, A.R., Alaka, I.C., Faasema, J. and Yaji, T.A. (2016). Quality Evaluation of Herbal tea Blends from Ginger and pavetta crassipes. *European journal of medicinal plants*, 12(4): 1 – 8.

Alobi, N.O., Ikpeme, E.M., Okoli, A.L., Etim, K.D. and Eja M.E (2012). Phytochemical and Nutritional profile of lasianthera Africana, Heinsia crinata and Gongronema latifolium. *New York Sci. J.*, 5 (3): 45 – 48.

AOAC (2000) Official Methods of Analysis. 17th Edition, The Association of Official Analytical Chemists, Gaithersburg, MD, USA. Methods 925.10, 65.17, 974.24, 992.16

Balogun, M. E., Besong, E. C., Obimma, J. N., Mbamalu, O. S. and Djobissie, S. F. A. (2016). *Gongronema Latifolium:* A Phytochemical, Nutritional and Pharmacological Review. *Journal of Physiology and Pharmacology Advances*, 6(1): 811-824

Bligh, E. G. and Dyer, W. J. (1959). A rapid method of total lipid extraction and purification. *Canadian journal of biochemistry and physiology*, *37*(8): 911–917. https://doi.org/10.1139/o59-099

Chanda, S. and Ramachandra, T. V. (2019). A review on some therapeutic aspects of phytochemicals presents in medicinal plants. *International Journal of Pharmacy and Life Sciences*, 10(1): 6052-6058.

Egbung, G., Atangwho, I.J., Iwara, I.A. and Eyong, U.E. (2011). Micronutrient and phytochemical composition of root, bark and twig extracts of Gongronema latifolium. *Journal of Medicine and Medical Sciences*, 2(11):1185-1188.

Eleyinmi, A. F. (2007). Chemical composition and antibacterial activity of Gongronema latifolium. *Journal of Zhejiang University. Science. B*, *8*(5): 352–358. https://doi.org/10.1631/jzus.2007.B0352

Emebu, P. and Anyika, J. (2011). Proximate and mineral composition of kale (brassica oleracea) grown in Delta State, Nigeria. . *Pakistan Journal of Nutrition*, 10(2): 190–194. https://doi.org/10.3923/pjn.2011.190.194

Fitzgerald, M., Micheal, H. and Anthony, B. (2020). Medicinal Plant Analysis; A historical and regional discussion of emergent complex techniques. *Journal of Frontiers in Pharmacology*, 10; 1.

Kahlon, T. S., Chiu, M. C. M. and Chapman, M. H. (2008). Steam cooking significantly improved in vitro bile acid binding of collard greens, kale, mustard greens, broccoli, green bell pepper, and cabbage. *Nutrition Research*, 28(6): 351–357. https://doi.org/10.1016/j.nutres.2008.03.007

Kiran M., Ebuna C., Mishra A., and Goyal M., (2018). Phytopharmaceutical Properties of Antimalarial Plants of Northeast India. *Journal of Ayurveda Integrated Medicine*, 3(1): 10-15. Doi; 10.4103/0975-9476.

Moinuddin Amrelia (2022). Nutririve and Medicinal Value of *Gongronema Latifolium* Benth. *Journal of natural products discovery*. 1(2): 1-4.

Morris, A., Barnett, A. and Burrows, O. (2004). Effect of processing on nutrient content of foods: A handbook of vegetables and vegetable processing. *Asian Journal of Biochemistry*, 37(3): 160–164.

Ndife, J., Alozie, E.N., Amaechi C., and Onwuzuruike, U.A (2020). Development of spice-mix seasonings from functional ingredients of Utazi (Gongronema latifolium), Uda (Xylopia aethiopica), Nchuanwu (Ocimum gratissimum), and Uziza (Piper guineense). *FUTO Journal Series* (FUTOJNLS), 6 (2): 174-189.

Offor, C. E. and Uchenwoke, I. O., (2015). Phytochemical Analysis and Proximate Composition of the Leaves of Gongronema Latifolium. *Global Journal of Pharmacology*, 9 (2): 159-162

Osuagwu, A. N., Ekpo, I.A., Okpako, E.C. and Ottoho, E. (2013). The Biology, Utilization and Phytochemical composition of the fruits and leaves of Gongronema Latifolium Benth. *Journal of Agrotechnology*, 2: 115-121.

Park K. (2023). The Role of Dietary Phytochemicals: Evidence from Epidemiological Studies. *Nutrients*, *15*(6): 1371. https://doi.org/10.3390/nu15061371.

Parsaeimehr, A., Martinez-chepa, S. O. Parra-saldivar, R., (2017). Medicinal Plants Versus Skin Disorders. A Survey from Ancient to Modern Herbalism. *Journal of Microbiology of Skin, soft tissue, bone and joint infections*. 2: 205-206.

Rasool, H. A. (2014). Medicinal Plants (importance and uses). *Journal of Phamaceutical Analytical Acta*, 3: 10-11.

Sofoworo, A., Ogunbodede, E. and Onayede A. (2013). The role & place of medicinal plants in the strategies for disease prevention. *African Journal of Traditional Complement Alternate Medicine*, 10(5): 200-229. PMID: 24311829.

Uzodinma, E.O. and Amie, L.N. (2016). Production and Evaluation of green. Wwhite and oolong tea from bushbuck leaf (gongronema latifolium) 2nd Regional food science and Technology summit Enugu. Pp.24-34.

Zaku S. G., Emmanuel S., Tukur A.A. and Kabir A. (2015). Moringa oleifera: An underutilized tree in Nigeria with amazing versality: a review. *African Journal of Food Science*. 9(9):456 – 461.

Table 1: Phytochemical Analysis of *Gongronema latifolium* (*Utazi*) in mg/100g

PHYTOCHEMICALS	SAMPLES	
	DRY	**FRESH**
Alkaloid	7.00 ± 0.06	7.40 ± 0.06
Tannin	3.24 ± 0.10	4.58 ± 0.09
Flavonoid	31.06 ± 0.17	30.02 ± 0.23
Oxalate	9.57 ± 0.08	9.84 ± 0.03
Phenol	23.59 ± 0.27	23.70 ± 0.25
Saponin	18.16 ± 0.23	19.15 ± 0.29
Steroid	5.41 ± 0.05	5.75 ± 0.05

Values on the table are means of triplicate determinations ± standard deviation**.**

Table 2: Proximate Analysis of *Gongronema latifolium* (*Utazi*) in %

NUTRIENTS	DRY	FRESH
Moisture	13.2 ± 0.21	78.60 ± 0.24
Protein	25.98 ± 0.07	2.43 ± 0.34
Ash	8.54 ± 0.19	2.80 ± 0.14
Fibre	12.33 ± 0.42	2.40 ± 0.19
Fat	1.97 ± 0.22	1.20 ± 0.04
Carbohydrate	45.57 ± 0.19	12.57 ± 0.25

Values on the table are means of triplicate determinations ± standard deviation**.**

Table 3: Vitamin Analysis of *Gongronema latifolium* (*Utazi*) in mg/100g

VITAMIN	DRY	FRESH
Beta-carotene	477.1 ± 0.58	478.2 ± 0.42
C (Ascorbic Acid)	44.27 ± 0.41	43.68 ± 0.32
E (α-Tocopherol)	0.46 ± 0.01	0.57 ± 0.01
B1 (Thiamine)	0.24 ± 0.06	0.29 ± 0.06

Values on the table are means of triplicate determinations ± standard deviation**.**