Int J Nutr Sci 2025;10(2):342-351

International Journal of Nutrition Sciences

Journal Home Page: ijns.sums.ac.ir

ORIGINAL ARTICLE

Nutritional Values of Brazilian Plume Flower (*Justicia carnea*) and Dandelion (*Taraxacum officinale*) Cultivated in Nigeria

Gregory Elayeche Oko[1], Vo Thi Kim Khuyen[2*], Emediong Anietie Udo[1], Chioma Dorcas Ikechukwu[1]

1. Department of Biochemistry, Faculty of Basic Medical Science, University of Calabar, Calabar, Nigeria
2. Department of Analytical Chemistry and Drug Quality Control, Faculty of Pharmacy, University of Medicine and Pharmacy at Ho Chi Minh City, Ho-Chi-Minh City, Vietnam

ARTICLE INFO

Keywords:
Brazilian plume flower
Dandelion
Justicia carnea
Taraxacum officinale
Nutritional value

**Corresponding author:*
Vo Thi Kim Khuyen, PhD;
Department of Analytical Chemistry and Drug Quality Control,
Faculty of Pharmacy,
University of Medicine and Pharmacy at Ho Chi Minh City, Vietnam.
Tel: +84-388244193
Email: vtkkhuyen@ump.edu.vn
Received: January 26, 2025
Revised: April 19, 2025
Accepted: April 28, 2025

ABSTRACT

Background: *Justicia carnea* known as Brazilian plume flower and dandelion (*Taraxacum officinale*) have drawn the research attention due to their potential health benefits, and lack of available scientific evidences. So this study assessed the nutritional values of these two Brazilian plume flowers cultivated in Nigeria.

Methods: The moisture content, total protein, crude fiber, ash percentage and levels of vitamins A, B, C and E and minerals were determined.

Results: Dandelion had a higher protein and fat content (28.25±0.35% and 24.00±0.71% protein, 15.19±0.02 and 12.94±0.09% fat), while Brazilian plume flower had a larger carbohydrate and fiber content (38.38±0.18 and 32.33±0.40% carbohydrate; 0.26±0.01% and 0.18±0.03% fiber). There were also differences in the composition of vitamins A, B, C and E in the leaves of *T. officinale* and *J. carnea*. The contents of vitamins A and B were higher in *J. carnea* (515.8±6.77 and 277.5±8.56 g/100 mg, respectively), whereas *T. officinale* accumulated a higher amount of vitamins C and E (5.15±0.24 and 0.96±0.01 g/100 mg, respectively). In addition, Brazilian plume flower contained a high mineral composition (iron, potassium, manganese, magnesium) compared to dandelion, except for copper, zinc, and sodium. No significant difference was seen in the calcium and phosphorus concentrations.

Conclusion: The two plant samples had different nutritional profiles, highlighting the significance of taking into account the macronutrients (carbohydrates, proteins, and fats) and micronutrients (vitamins and minerals) for dietary assessment and planning.

Please cite this article as: Oko GE, Khuyen VTK, Udo EA, Ikechukwu CD. Nutritional Values of Brazilian Plume Flower (*Justicia carnea*) and Dandelion (*Taraxacum officinale*) Cultivated in Nigeria. Int J Nutr Sci. 2025;10(2):342-351. doi: 10.30476/ijns.2025.104544.1361.

Introduction

The nutritional health and well-being of humans are entirely dependent on plant foods. For a long time, plants have played a very important role in human life. They are critical components of the dietary food chain, since they provide almost all essential mineral and organic nutrients to humans either directly or indirectly. There is a wide variety of indigenous vegetables that are good sources of nutrients and used in traditional medicine systems in Africa. Dandelion belongs to the Taraxacum genus, Asteraceae family with over three hundred species and is known for its yellow flowers turning into fluffy “blowballs” of seeds dispersed in the wind (1). They prefer well-drained soil with a pH range from 6.0 to 7.5, and can tolerate sandy or clay soils too. In Asia, the Taraxacum genus is widely cultivated and is also found as a wild genus on lawns, disturbed banks, shores of waterways and other areas with moist soils in most parts of China, North Korea, Mongolia, and Russia (2). Dandelion seed reproduction indices are recommended as a bioindicator to assess the level of environmental pollution, since they often grow in urbanized territories near roadsides with different intensities of traffic (3). Their deep taproots help improve soil health by aerating and bringing up nutrients from deeper layers. Dandelions contain latex, a type of rubber, and can be extracted and used as a natural alternative for rubber production (4).

As an edible herb, dandelion has long been utilized in folk remedies, and substitution therapies in many countries (5). The leaves of cultivated or wild species can be eaten in salads, soup and beverages like herbal tea, while roots are baked and used as a coffee substitute (6). Dandelion flowers have antioxidant activity (7), the leaves can stimulate appetite and improve upset stomach (8), and the extract can be used as diuretics (8). Root extracts have been reported to have anti-inflammatory and anti-cancer properties such as pancreatic and prostate cancer (9, 10), human leukemia (11), and colorectal (12). Dandelion also has cultural significance in societies, such as symbols of resilience and transformation (13).

Justicia carnea that has different names such as Jacobinia, Brazilian plume flower, Flamingo plant, shrimp plant, and called Jesus in Nigeria belong to the Justicia genus, Acanthaceae family. *J. carnea* is a flowering plant native to Central and South America (14), and is widely distributed in various parts of Africa. Brazilian plume flowers are primarily valued for ornamental qualities rather than socioeconomic benefits. It is a popular landscaping plant due to its vibrant flowers and lush foliage that contributes aesthetically to gardens and public spaces. In Nigeria, the shrubs grow around homesteads as fences and are easy to grow from stem cuttings by pushing the stems 1 to 2 inches into the soil. The deep purple juice from the leaves extracted either by soaking or boiling in water can be drunk as tea. In other localities in Nigeria, the raw leaves are chewed and used together with “nchuanwu” as culinary vegetables to garnish yam porridge.

The chemical composition of *J. carnea* includes terpenoids, tannins, alkaloids, carbohydrates, flavonoids, saponins, phenols, reduced sugar and glycosides. Phenols and flavonoids were found in high concentrations which could be responsible for the anticancer and antioxidant activities exhibited by the plant (15). *J. carnea* possesses antinociceptive, anti-allergic, anti-tumoral, anti-viral, anti-inflammatory, analgesic, pain-relieving, antioxidant and hepatoprotective activities (16). The leaf extracts have been explored for treating fever, gastrointestinal disorders, respiratory tract infection, fever, pain, diabetes, diarrhea, liver diseases, rheumatism and arthritis (17). The resultant liquid after boiling leaves is usually crimson red (18) that are used for anemic patients, women who want their blood replenished after the menstrual cycle, and pregnant women.

Taraxacum officinale dandelion and *J. carnea* have historical uses in traditional medicine and culinary practices in various cultures and traditional medicine systems. They are known to contain a wide range of phytochemicals, including vitamins, minerals, and bioactive compounds. However, there is a lack of recent scientific research that compares nutritional compositions of these two plants. This knowledge gap hinders our understanding of their potential as valuable dietary resources and their contribution to human nutrition. Therefore, the primary problem to be addressed is assessing and comparing their nutritional values. This study was carried out to provide insights into proximate compositions, vitamins, and minerals that are capable of promoting well-being of these two plants. Proximate composition analysis includes the determination of protein, fat, fiber, ash, moisture content/dry matter, carbohydrate content and energy. The study results help us understand the potential health benefits and dietary contributions that these plants can offer.

Materials and Methods

Dandelion leaves are long and tooth-shaped, forming a rosette at the base of the plants. The leaves were freshly harvested from mature plants on a homestead in Eket Local Government, Akwa-Ibom State Nigeria (Figure 1), taken to the laboratory for analysis to avoid unnecessary moisture loss. In the laboratory, a portion of the fresh leaves was used for wet moisture content determination. The other portion was prepared for chemical analysis. The leaves were washed with distilled water to remove all impurities, dried at room temperature for days and in an oven at 60°C for 30 minutes to remove residual moisture. The completely dried leaves were ground into powder which were used to test for dry moisture content, protein, fat, ash content (minerals) and vitamins.

Figure 1: Fresh leaves of *T. officinale* dandelion (left) and *J. carnea* plume flower (right) before the experiments.

The gravimetric method was applied to determine moisture content. The initial weight of the wet material was compared to the weight of the water it contained to determine wet moisture content (19). A sample of 10 g was weighed before and after drying in the oven at 105°C to the constant weight. The dry moisture was calculated as a percentage of the ratio of moisture loss to the weight of samples analyzed. Ash percentage was determined by the furnace incineration gravimetric method. The organic component of 5 g of each sample was burnt off at high temperature of 600°C in an electric muffle furnace until the sample became gray ash. The ash was cooled in a desiccator before it was reweighed. The weight of inorganic matter that was left was calculated by difference as a percentage of the sample analyzed. The ash was reserved for acid extraction and subsequent mineral determination.

Crude fiber was analyzed by the Weende method (20, 21). Five grams of a sample were boiled in 200 mL of 1.25% H_2S0_4 solution for 30 minutes and washed in hot distilled water using a two-fold muslin cloth to retain the sample particles. A total of 200 mL of 1.25% NaOH solution was added to the sample and boiled again for 30 minutes and then was transferred to a weighed porcelain crucible. The sample was dried in the oven at 105°C for 1 hour, weighed and recorded. The sample was burnt to ashes in a muffle furnace, cooled, reweighed and recorded. The crude fiber content (%) was calculated by difference between two weighing times. Crude fat was extracted by continuous solvent extraction with n-hexane in a soxhlet apparatus (Excello, England) (21, 22). The process was repeated for about 4 hours before the defatted sample was carefully removed and dried in the oven at 100°C for 30 minutes, cooled and weighed. The fat content was determined as the weight loss (%) due to extraction from the sample.

The total protein was determined by the Kjeldahl method (23) and multiplied with factor 6.25 to obtain the crude protein content (in %). Briefly, 0.5 g was boiled in 10 mL of concentrated H_2SO_4 in the presence of a selenium catalyst until a clear solution was obtained. The digest was diluted to 100 mL with distilled water in a volumetric flask. Totally, 10 mL of the digest was mixed with an equal volume of 40% NaOH solution and 10 mL of 4% boric acid solution and mixed indicator (methyl red and bromocresol green) were later added. A total of 50 mL of the mixture was titrated against 0.02 N HCl solution to reach a deep red end point.

Regarding vitamin A (retinol), one gram of a sample was macerated in 20 mL of n- hexane for 10 minutes. Then 3 mL of the upper hexane extract was evaporated to dryness and 0.2 mL of acetic anhydride chloroform reagent (1:1v/v), and 50% trichloroacetic acid:chloroform (1:1v/v) were respectively added. The absorbance was measured and the concentration of vitamin A was extrapolated from the standard curve. For vitamin B, 0.2 grams of the ground sample were taken into a 250 mL flask, and dissolved by 3 mL of 1 M NaOH. A total of 3 mL of ethanoic acid was added and the solution was marked with distilled water. Vitamin B standard (100 ppm) and working standards (2.5, 5.0, 7.5 and 10 ppm) were prepared with 1% glacial ethanoic acid to make the standard curve. The absorbance was measured at 240 nm and 550 nm to choose the optimal wavelength for vitamin B analysis.

Considering vitamin C (ascorbic acid), 0.5 g of the sample was macerated in 10 mL of 0.4% oxalic acid for 10 minutes, and centrifuged for 5 minutes before filtration. Totally, 1 mL of the filtrate was transferred into a tube containing 9 mL of 2, 6-dichlorophenol indophenol, and was titrated against a solution containing 295 mg/L DPIP and 100 mg/L sodium bicarbonate. In relation to vitamin E, one gram of a sample was macerated in 20 mL of ethanol and filtered. The 1 mL of 0.2% ferric chloride in ethanol and 1 mL of 0.5% α-α-dipyridine were added to the filtrate. This was diluted to 5 mL with water. Standard solutions were prepared similarly and measured the absorbance to calculate vitamin E concentration in the samples.

The minerals of Zn, Fe, Cu, Mg, Mn, Ca, Na, K and P, Ni, Co, Pb, Hg were determined according to AOAC (Na and K by Sherwood flame Photometer model 420, P by Labtech Advance microprocessor single Beam UV-VIS Spec. 295 and the rest was read by Rayleigh AAS WFX320 after a wet digestion with 1:3 70% perchloric acid and nitric acid). The data were reported as mean and standard error of the mean. The proximate compositions were expressed in %, minerals were in mg/g, and vitamins were in mg/100 g of the sample. The comparison in parameters between the two plant species was evaluated by one-way ANOVA with a $p=0.05$.

Results

The proximate analysis of *T. officinale* (dandelion) and *J. carnea* (plume flower) was shown in Figure 2. Moisture content varied significantly between the two species. Dandelion had a wet moisture content of 84.57±3.37%, while *J. carnea* recorded 0.00±0.00%, indicating a complete loss of water in the latter's fresh sample or drying method. In terms of dry moisture, *J. carnea* had a higher value than dandelion, although specific numerical values were not stated. This may influence both shelf-life and processing suitability. The ash content, which represented the total mineral residue, was 14.68±0.69% for dandelion and 13.25±0.25% for *J. carnea* that reveals no significant difference. Protein content was notably higher in dandelion as 28.25±0.35% when compared to *J. carnea* as 24.00±0.71%, indicating a stronger potential for dietary protein supplementation for dandelion. Fiber content was extremely low in both species; while dandelion had only 0.18±0.03% that was far below the 3.7±0.09% reported in Brazilian dandelion. There was a significant difference in wet and dry moisture while no difference was found in the ash content (Unpaired T-test with Welsh correction).

Fat content was another area of difference as 15.99±0.02% in dandelion versus 12.94±0.09% in *J. carnea*. These values are below the 20-35% RDA for fats and suggest a moderate energy contribution. Regarding carbohydrate content, *J. carnea* provided 38.38±0.18%, while dandelion had 32.33±0.40% and both were notable; but insufficient as standalone carbohydrate sources. Figure 3 shows the vitamin contents of both species. *J. carnea* had the highest vitamin A concentration as 515.8±6.77 µg/100 g, higher than dandelion value. In vitamin B, *J. carnea* also outperformed dandelion, showing 277.5±8.56 µg/100 g versus 250.0±7.07 µg/100 g in dandelion. Conversely, vitamin C was higher in dandelion as 5.15±0.24 µg/100 g, though this was low when compared to 35.02±0.22 µg/100 g in Brazilian dandelion. Vitamin E was the lowest in both plants, but dandelion had insignificantly more vitamin E than *J. carnea*. Table 1 presents mineral data (mg/g). *J. carnea* had higher values for iron (Fe, 0.11±0.02), calcium (Ca, 0.06±0.01), potassium (K, 0.12±0.01), phosphorus (P, 0.18±0.01), manganese (Mn, 0.11±0.01), and magnesium (Mg, 0.16±0.01). Dandelion showed greater values in cupper (Cu, 0.12±0.01), zinc (Zn, 0.06±0.01), sodium (Na, 0.12±0.01), and similar levels of P (0.11±0.01) and Mg (0.05±0.01).

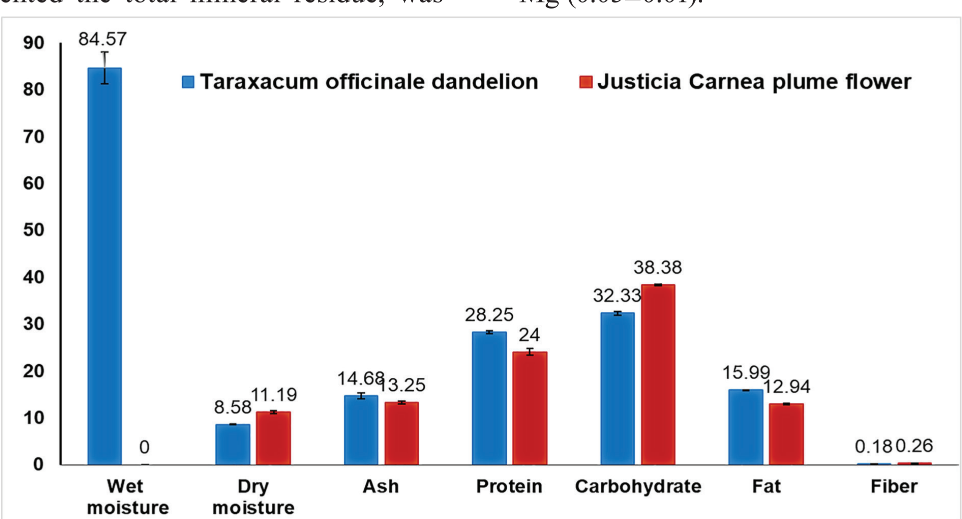

Figure 2: Comparison of proximate compositions in two plants. The bar represents the standard error of mean (SEM).

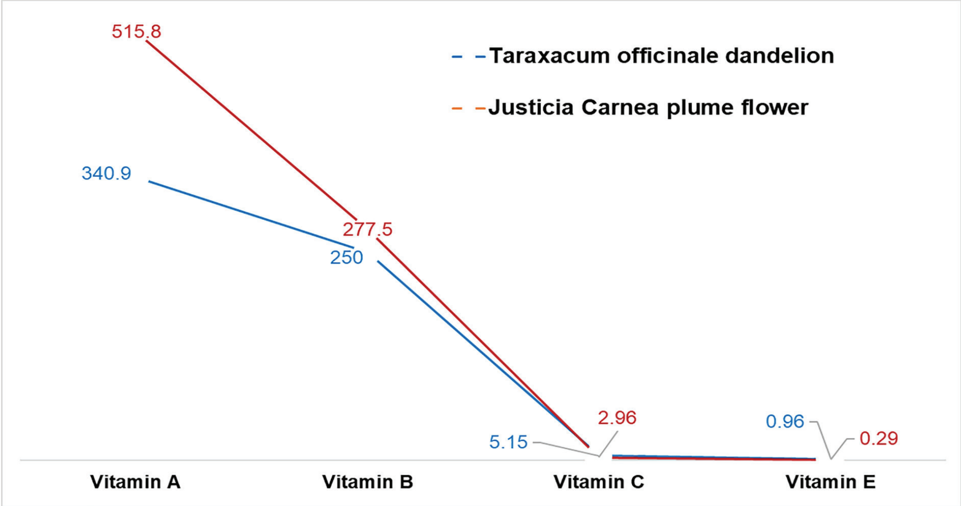

Figure 3: Comparison of vitamin compositions in two plants.

Table 1: Comparison of mineral compositions in two plants.

Mineral Composition (mg/g)	*T. officinale* dandelion	*J. carnea* plume flower
Fe	0.02±0.01	0.11±0.02
Zn	0.06±0.01	0.05±0.01
Cu	0.12±0.01	0.08±0.03
Ca	0.05±0.01	0.06±0.01
K	0.01±0.007	0.12±0.01
Na	0.12±0.01	0.06±0.01
P	0.11±0.01	0.18±0.01
Mn	0.02±0.01	0.11±0.01
Mg	0.05±0.01	0.16±0.01

Values were presented as mean±standard deviation (SD). Ca: calcium, Cu: Cupper, Fe: Iron, K: potassium, Mg: Magnesium, Mn: Manganese, Na: Sodium, P: phosphorus, Zn: Zinc.

Discussion

Our findings indicated a substantial nutritional diversity between *T. officinale* and *J. carnea*, especially in their moisture, protein, fat content and carbohydrate. Dry moisture content expressed in percent refers to the amount of water present in the plants after being dried to remove all moisture. It is a measure of the remaining solid mass to provide insights into plant health and harvesting conditions. Dandelion had lower dry moisture when compared to Brazilian plume flower, which could influence the textural properties and shelf life when dried. Wet moisture content demonstrated the percentage of water in a fresh sample (in natural or wet form). This parameter serves as measuring the water availability and making irrigation decisions. In food processing, it is crucial to assess the freshness and quality of raw plants. Dandelion's extremely high wet moisture (84.57±3.37%) in comparison to *J. carnea* (0.00±0.00%) revealed its fresh leaves to retain significantly more water and make it suitable for hydrating diets; but was less stable for storage. The dandelion leaves in this study were within the ranges of leafy vegetables consumed in Nigeria (58.0-93.4%).

The role and importance of herbal in treating diseases make them a suitable substitution for chemical remedies. Therefore the knowledge of their content can be beneficial when administered in treatment measures (24). Ash content in the plants refers to the inorganic residues that remain after complete combustion or incineration. It represents the minerals and other inorganic components present in the original material and is often expressed as a percentage of the dry weight. Ash content was consisted of minerals such as calcium, potassium, magnesium, phosphorus, and trace elements that were in the organic materials. These minerals did not combust during the burning process and remained as ash. Ash content is used to quantify the impurities or non-combustible elements in a sample. Ash content in plant materials can provide insights into soil fertility (25), purity of herbal extracts and plant-based products (26). Ash contents of dandelion (14.68±0.69%) and *J. carnea* were not significantly different (13.25±0.25%) that was lower than a previous study with 23.91% (27).

Proteins in plants play a crucial role in various physiological processes and contribute to the overall health and function of the plant. Proteins participate in signaling pathways that regulate various aspects of plant growth and development. These signaling proteins transmit information about environmental conditions, such as light, temperature, and nutrient availability, helping the plant adapt to its surroundings. Transport proteins facilitate the movement of ions and other molecules across cell membranes, ensuring the plant receives the necessary nutrients for its metabolic processes (27). The protein content, a critical determinant of nutritional quality, was higher in dandelion (28.25±0.35%) when compared to *J. carnea* (24.00±0.71%), while dandelion outperforming earlier values were reported in another study (2.3±0.01%) and this finding can supports dandelion use in protein-enriched dietary interventions (27).

Fiber content in plants refers to the presence of dietary fibers within the plant material. Dietary fibers are complex carbohydrates that are resistant to digestion by enzymes in the human digestive system. These fibers are essential for various aspects of human health and play important roles in plant structure. Fiber provides structural support to plant cell walls, contributing to the overall integrity of the plant. Fiber-rich foods are often lower in calorie density, promoting a feeling of fullness and aiding in weight management (28). Both plant species in our study contained a low amount of fiber. The fiber in our dandelion samples was only 0.18±0.03%, much lower than 3.7±0.09% in dandelion in Brazil. Hence dandelion is recommended to be incorporated into meals containing fiber-rich foods (29).

Plants store energy in the form of fats. Seeds, in particular, contain high concentrations of fats that serve as an energy reserve for germination and early seedling growth. Fats are integral components of plant cell membranes, contributing to their structure and function. Plant-based fats are part of a balanced diet and provide essential fatty acids (such as omega-3 and omega-6) that the human body cannot produce on its own. The type of fat and its composition are crucial for health. Unsaturated fats, found in many plant sources, are generally considered healthier than saturated fats. Laboratory methods, such as lipid extraction and chromatography, are employed to analyze the fat content and fatty acid composition in both plants. Determination of fats is essential to build healthy and balanced diets, especially for vegetarians. In this study, the fat of dandelion (15.99±0.02) was higher than *J. carnea* (12.94±0.09%), and also much higher than Brazilian dandelion (29) as only 1.2±0.03%. The recommended daily allowance (RDA) for total fats is 20-35% of calories from fats, hence dandelion is below the range of fat required in nutrients. Carbohydrates produced through photosynthesis are stored as starch in plants, and they serve as a primary energy source during growth and metabolic processes for both plants and humans. Analysis of carbohydrate content aids in assessing the productivity of crops, especially those grown for food or bioenergy purposes, understanding plant health, nutritional quality, and supporting various applications across agriculture, industry, and scientific research (30). Carbohydrate content in our dandelion (32.33±0.40%) was higher than that of most conventional vegetables, but was lower than *J. carnea* (38.38±0.18%). The RDA for total carbohydrate was 45-65%, and both of these plants could not provide the required amount of carbohydrates when consumed alone in the diets.

Vitamin A, in the form of carotenoids like beta-carotene, acts as an antioxidant. Antioxidants help neutralize harmful free radicals in the body, protecting cells from oxidative stress and reducing the risk of chronic diseases (31, 32). Vitamin A also plays a key role in the function of the retina, contributing to the formation of light-sensitive pigments necessary for low-light and color vision. Vitamin A supports the maintenance and repair of epithelial tissues, contributing to skin integrity. Retinoids derived from vitamin A are used in dermatology for various skin conditions (33). Certain plants contain provitamin A carotenoids, such as beta-carotene, which the body can convert into active vitamin A. We showed *J. carnea* to have significantly higher concentrations of vitamin A (515.8±6.77), thereby being a potential good dietary source of vitamin A.

Vitamin B refers to a group of water-soluble vitamins that are essential for various physiological functions in both plants and animals. B vitamins, such as B1 (thiamine), B2 (riboflavin), B3 (niacin), B5 (pantothenic acid), and B7 (biotin), play crucial roles in energy metabolism by participating in the breakdown of carbohydrates, fats, and proteins. Vitamin B12 and folate are essential for the formation of red blood cells. Deficiencies in these vitamins can lead to anemia due to impaired blood cell production. The B vitamins are necessary for plant growth and development and they contribute to processes like cell division, elongation, and differentiation in plants. Vitamin B complex plays a key role in energy metabolism and nervous system function. These vitamins are essential for converting food into energy, maintaining healthy skin and muscle tone, supporting immune and nervous system function, and promoting cell growth and division. *J. carnea* (277.5±8.56%) of our study had a higher concentration of vitamin B than dandelion (250.0±7.07). Vitamin B in dandelion in this study (250.0±7.07%) was higher than the measurement of others as 0.19±0.26% (29). Both plants in our study could be considered as good sources of vitamin B, but *J. carnea* might be more beneficial for dietary purposes related to these nutrients.

Vitamin C, also known as ascorbic acid, is a crucial nutrient with various roles in both plants and animals. Vitamin C is a potent antioxidant that helps neutralize harmful free radicals in both plant and human cells. It is involved in various stages of plant growth and development, including photosynthesis, cell expansion, differentiation, and protection against environmental stressors and pathogens. For humans, vitamin C is essential for the synthesis of collagen, and the production and function of white blood cells in the immune system (34). Vitamin C in the investigated plants of our study was not high when compared to vitamins A and B. In contrast to vitamin B, our finding (5.15±0.24%) was lower than the results of other researchers that was up to 35.02±0.22% in Brazilian dandelion (29).

Vitamin E acts as a potent antioxidant that protects cells and tissues from damage and oxidative stress caused by free radicals. It prevents the oxidation of lipids, which is important for maintaining the structural integrity of cell membranes. Vitamin E is involved in supporting the activity of certain enzymes, particularly those involved in cellular detoxification processes (35). Due to the anti-inflammatory properties, vitamin E is important to manage chronic inflammatory conditions. It is important for reproductive health in both plants and animals by protecting reproductive tissues and supporting fertility (36). Both of these plants in our study were not a rich source of vitamin E, and again dandelion in our study was lower than dandelion samples of a previous report that was up to 12.6±0.2% (29).

Copper serves as a cofactor for several enzymes involved in essential processes within plants such as synthesis of chlorophyll, photosynthesis, respiration, metabolism of carbohydrates, proteins, lipids, pollination and reproductive development in plants (37). It plays a role in the regulation of iron uptake, absorption, transport and utilization and nutrient balance within the plant. *J. carnea* has been reported to be rich in trace minerals and macronutrients, especially in calcium and iron (15, 31). Indeed, iron was very low in our samples, suggesting their potential use for anemia cure (15). Calcium was one of the elements with low concentration in our *J. carnea* samples. Sodium is not an essential nutrient for most plants, but some plants can take up and accumulate sodium, including *T. officinale* dandelion. Sodium accumulation in plants can be a response to environmental stress, such as high salinity in the soil. This ion and magnesium contribute to osmotic regulation in plant cells, helping the plants to tolerate and adapt to challenging conditions, particularly in environments with elevated salinity, drought, and temperature fluctuations. Copper and sodium accumulated in our dandelion in the same contents, were twice as high as *J. carnea,* suggesting that dandelion is a good source of copper and sodium for vegans (37).

Phosphorus plays fundamental roles in plant growth, energy production, storage and transfer, and various physiological processes such as photosynthesis and respiration (38). Magnesium is involved in the metabolism of phosphate compounds, thereby influencing the uptake and utilization of phosphorus. Similar to phosphorus and manganese, cooper and magnesium support the root development for nutrient uptake and plant stability, but they are also crucial for flowering and seed formation (28). Phosphorus, magnesium and sodium contents in dandelion in our study were lower than another report (0.57±0.03%, 1.98±0.92% and 1.45±0.12%, respectively) (29). Potassium and manganese play critical roles in photosynthesis and various physiological processes of plant growth such as formation of functional proteins. Potassium and magnesium regulate water uptake and maintains ion balance within plant cells (39). Potassium acts as an activator and manganese is a cofactor for many enzymes responsible for photosynthesis, respiration, and nutrient uptake (40). The potassium and manganese contents were similar in our dandelion. This was also observed in the case of *J. carnea*. These two minerals enhance the resistance of plants to certain diseases and pathogens. In humans, manganese is involved in bone formation, fat and carbohydrate metabolism, calcium absorption, and blood sugar regulation (39). *J. carnea* of our study had higher potassium and manganese contents than dandelion, which can be beneficial for the dietary intake. A high potassium diet can help reduce blood pressure and water retention, protect against stroke, and prevent osteoporosis and kidney stones (39, 40).

Conclusion

The nutrient composition of *J. carnea* and dandelion revealed distinct nutritional profiles, while each offered unique health benefits. *J. carnea* had a different set of phytochemicals, vitamins, and minerals when compared to dandelion, which is renowned for its refreshing flavor and diverse culinary uses. Protein and fat contents were relatively higher in dandelion with values of 28.25±0.35% and 15.99±0.02%, respectively in comparison to plume flower with values of

24.00±0.71% and 12.94±0.09%, respectively. But, by contrast, carbohydrate and fiber contents were significantly higher in *J. carnea,* up to 38.38±0.18% and 0.26±0.01%, respectively. Specific nutrient compositions can vary based on environmental factors and cultivation methods. Both plants held significant value in nutritional and medicinal contexts, highlighting the diversity and richness of plant-based nutrients, especially when they were choices for those looking to supply carbohydrate, and vitamins A and B intake through diets. The metal ions were not high in both plants, and their quantities varied in the similar range. The contents of copper and sodium were the same and also the highest in *T. officinale* dandelion (0.12±0.01 mg/g), and the lowest minerals were potassium (0.01±0.007 mg/g), iron and manganese (0.02±0.01 mg/g). In contrast, these metals were high in *J. carnea* plume flower (0.11 mg/g on average). The highest minerals in *J. carnea* were phosphorus (0.18±0.01 mg/g) and magnesium (0.16±0.01 mg/g). So understanding their specific compositions in each plant can provide insights into their dietary and health promotion. A comparative study can shed light on the suitability of each plant for dietary and medicinal purposes to aid choices for consumption.

Acknowledgment

None.

Funding

None.

Authors' Contribution

GE.O: Conceptualization/design of the work, Data curation, Methodology, Supervision, Funding acquisition. VTK.K: Methodology, Formal analysis, Writing, Visualization, Funding acquisition. EA.U and CD.I: Software, Investigation, Formal analysis.

Conflict of Interest

The authors declare no conflicts of interest.

References

1 Li Y, Chen Y, Sun-Waterhouse D. The potential of dandelion in the fight against gastrointestinal diseases: A review. *J Ethnopharmacol.* 2022;293:115272. DOI: 10.1016/j.jep.2022.115272. PMID: 35405251.

2 Zhang Y, Zhao D, Xu J, et al. Effects of dietary factors on the pharmacokinetics of Fe-labeled hemin after oral administration in normal rats and the iron-deficient rats. *Biol Trace Elem Res.* 2021;153:243-250. DOI: 10.1007/s12011-013-9654-3. PMID: 23584844.

3 de Baaij JHF, Hoenderop JGJ, Bindels RJM. Magnesium in man: implications for health and disease. *Physiol Rev.* 2015;95:1-46. DOI: 10.1152/physrev.00012.2014. PMID: 25540137.

4 Ivanov I, Petkova N, Tumbarski J, et al. GC-MS characterization of n-hexane soluble fraction from dandelion (Taraxacum officinale Weber ex F.H.Wigg.) aerial parts and its antioxidant and antimicrobial properties. *Z Naturforsch C J Biosci.* 2018;73:41-47. DOI: 10.1515/znc-2017-0107. PMID: 28902635.

5 Stewart-Wade SM, Neumann S, Collins LL, et al. The biology of Canadian weeds. 117. *Taraxacum officinale* G. H. Weber ex Wiggers. *Can J Plant Sci.* 2002;82:825-853. DOI: 10.4141/p01-010.

6 Napoli A, Zucchetti P. Comprehensive review of benefits of *Taraxacum officinale* on human health. *Bull Natl J Res Cent.* 2021;45:110. DOI:10.1186/s42269-021-00567-1.

7 Saratale RG, Benelli G, Kumar G, et al. Bio-fabrication of silver nanoparticles using the leaf extract of an ancient herbal medicine, dandelion (*Taraxacum officinale*), evaluation of their antioxidant, anticancer potential, and antimicrobial activity against phytopathogens. *J Environ Sci Pollut Res Int.* 2018;25:10392-10406. DOI: 10.1007/s11356-017-9581-5. PMID: 28699009.

8 Pieroni A, Nedelcheva A, Dogan Y. Local knowledge of medicinal plants and wild food plants among Tatars and Romanians in Dobruja (South-East Romania). *J Genet Resour Crop Evol.* 2015;62:605. DOI: 10.1007/s10722-014-0185-3.

9 Nguyen C, Mehaidli A, Baskaran K, et al. Dandelion root and lemongrass extracts induce apoptosis, enhance chemotherapeutic efficacy, and reduce tumor xenograft growth in vivo in prostate cancer. *Evid Based Complement Alternat Med.* 2019:2951428. PMCID: DOI: 10.1155/2019/2951428. PMID: 31391857.

10 Ovadje P, Chochkeh M, Akbari-Asl P, et al. Selective induction of apoptosis and autophagy through treatment with dandelion root extract in human pancreatic cancer cells. *Pancreas.* 2012;41:1039-1047. DOI: 10.1097/MPA.0b013e31824b22a2. PMID: 22647733.

11 Ovadje P, Chatterjee S, Griffin C, et al. Selective induction of apoptosis through activation of caspase-8 in human leukemia cells (Jurkat) by dandelion root extract. *J Ethnopharmacol.* 2011;133:86-91. DOI: 10.1016/j.jep.2010.09.005. PMID: 20849941.

12 Ovadje P, Ammar S, Guerrero JA, et al. Dandelion root extract affects colorectal

cancer proliferation and survival through the activation of multiple death signaling pathways. *Oncotarget*. 2016;7:73080-73100. DOI: 10.18632/oncotarget.11485. PMID: 27564258.
13 Martinez M, Poirrier P, Chamy R, et al. *Taraxacum officinale* and related species - an ethnopharmacological review and its potential as a commercial medicinal plant. *J Ethnopharmacol.* 2015;169:244-262. DOI: 10.1016/j.jep.2015.03.067. PMID: 25858507.
14 Smith, JD, Ahmed I. Phytochemicals from Justicia species—A review. *J Appl Pharm Sci.* 2018;8:167-172.
15 Orjiakor CA, Uroko RI, Njoku OU, et al. Nutritive properties of aqueous extract. *Justicia Carnea* leaves and its Effects on hematological and some biochemical indices of anemia induced male Wistar albino rats. *Biomed Res.* 2019;30:177-182. 10.35841/biomedicalresearch.30-18-666
16 Ukpabi-Ugo J, Chigozue L, Uhuo EN. Evaluation of subacute toxicity of methanol extract of *Justicia Carnea* leaves in wistar albino rats. *Animal Res Int.* 2023;20,4862-4875.
17 Corrêa GM, Alcântara AF. Chemical constituents and biological activities of species of Justicia: a review. *Revista Brasileira de farmacognosia*. 2012;22:220-238. DOI: 10.1590/s0102-695x2011005000196.
18 Anarado EC, Ajiwe IE, Anarado JOC, et al. The Phytochemistry, Ethnomedicinal and Pharmacology Uses of Justicia Carnea Lindl Used in Traditional medicine in Nigeria-A Review. *South Asian Res J Natural Products.* 2021;10:140-146.
19 Bajwa AA, Mahajan G, Chauhan BS. Nonconventional weed management strategies for modern agriculture. *Weed Sci.* 2015;63:723-747. DOI: 10.1614/ws-d-15-00064.1.
20 FAO. Traditional Food Plants. Food and Agriculture Organisation (FAO/UN), Rome, 1988.
21 Ibitoye AA. Laboratory Manual on Basic Soil Analysis. 3rd Edition. 2008.
22 Achikanu CE, Eze-Steven PE, Ude CM, et al. Determination of the vitamin and mineral composition of common leafy vegetables in south eastern Nigeria. *Int J Curr Microbiol App Sci.* 2013;2:347-353.
23 Kjeldahl J. A New Method for the Determination of Nitrogen in Organic Matter. *Zeitschrift für Analytische Chemie.* 1883;22:366-382. DOI:10.1007/BF01338151.
24 Mohtasham Amiri Z, Tanideh N, Seddighi A, et al. The Effect of Lithospermum officinale, Silver Sulfadiazine and Alpha Ointments in Healing of Burn Wound Injuries in Rat. *World J Plast Surg.* 2017;6:313-318. PMID: 29218280.
25 Kumar S, Prasad AK, Iyer SV, et al. Systematic pharmacognostical, phytochemical and pharmacological review on an ethno medicinal plant, *Basella alba L. J Pharmacognosy Phytother.* 2013;5:53-58.
26 Motegaonkar MB, Salunke SD. The Ash and Iron Content of Common Vegetable Grown in Latur District, India. *Res J Recent Sci.* 2012;1:63-66.
27 Ilodibia, C. V. et al. Proximate Composition, Vitamin and Anatomical Studies on Gomphrena celosioides. *Annual Res Rev Biol.* 2016;10:1-6. DOI: 10.9734/arrb/2016/25546.
28 Hassanshahi N, Masoumi SJ, Mehrabani D, et al. The healing effect of Aloe vera gel on acetic acid-induced ulcerative colitis in rat. *Middle East J Dig Dis.* 2020;12:154-61. DOI: 10.34172/mejdd.2020.177. PMID: 33062220.
29 de Almeida LC, Salvador MR, Pinheiro-Sant'Ana HM, et al. Proximate composition and characterization of the vitamins and minerals of dandelion (*Taraxacum officinale*) from the Middle Doce River region - Minas Gerais, Brazil. *Heliyon*. 2022;8:e11949. PMID: 36478818. DOI: 10.1016/j.heliyon.2022.e11949.
30 Slavin JL . Structure, nomenclature, and properties of carbohydrates. In: Stipanuk MH, Caudill MA, editors. J.Biochemical, physiological, and molecular aspects of human nutrition. St. Louis: Elsevier, Inc; 2013.p.50-68.
31 Udedi, SC, Ani ON, Asogwa KK, et al. In-vitro and In-vivo Antioxidant Activity of ethanol leaf Extract of *Justicia carnea*. *Int J Biochem Res Rev.* 2020;29:48-60. DOI: 10.9734/ijbcrr/2020/v29i630194.
32 Ahmadu T, Ahmad K. An Introduction to Bioactive Natural Products and General Applications. *J Advance Structure Materials.* 2021;140:41-91. DOI: 10.1007/978-3-030-54027-2_2.
33 Kelly ME, Ramkumar S, Sun W, et al. The Biochemical Basis of Vitamin A Production from the Asymmetric Carotenoid β-Cryptoxanthin. *J ACS Chem Biol.* 2018;13:2121-2129. DOI: 10.1021/acschembio.8b00290. PMID: 29883100.
34 Kishimoto Y, Saito N, Kurita K, et al. Ascorbic acid enhances the expression of type 1 and type 4 collagen and SVCT2 in cultured human skin fibroblasts. *Biochem Biophys Res Commun.* 2013;30:579-584. DOI: 10.1016/j.bbrc.2012.11.110. PMID: 23228664.
35 Niki E, Traber MG. A history of vitamin E. *J Ann Nutr Metab.* 2012;61:207-212. DOI: 10.1159/000343106. PMID: 23183290.

36 Howard AC, Anna K, McNeil AK, et al. Promotion of plasma membrane repair by vitamin E. *Nat Commun.* 2011;20:597. DOI: 10.1038/ncomms1594. PMID: 22186893.
37 Fruth B, Mato B, Lukoki F, et al. Care for Health and Body: An Ethnobotanical Approach to Nkundo Plant Use (Cuvette Centrale, DRC) with focus on the Significance of Indigenous Knowledge for the Human Skin. *Curare*. 2011;34:263-284.
38 Angelova PR, Baev AY, Berezhnov AV, et al. Role of inorganic polyphosphate in mammalian cells: From signal transduction and mitochondrial metabolism to cell death. *Biochem Soc Trans.* 2016;44:40-45. DOI: 10.1042/BST20150223. PMID: 26862186.
39 Grober U, Schmidt J, Kisters K. Magnesium in prevention and therapy. *Nutrients*. 2015; 7:8199-8226. DOI: 10.3390/nu7095388. PMID: 26404370.
40 Fulgoni VL, Keast DR, Bailey RL, et al. Food fortificants, and supplements: where do Americans get their nutrients? *J Nutr*. 2011;141:1847–1854. DOI: 10.3945/jn.111.142257. PMID: 21865568.