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Phytochemistry and Nutritional Profile of Chromolaena Odorata Leaves

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Abstract

Chromolaena odorata (*C. odorota*) is a rapidly growing perennial herb. Several parts of this herb have been used to treat wounds, burns, and skin infections. This research aims to analyze the phytochemical constituents and nutritional profile of *C. odorota. Chromolaena odorata* leaves were used for the phytochemical analysis, vitamin analysis, mineral analysis, and proximate analysis. The proximate composition of *C. odorota* revealed that the leaves contain protein, fiber, carbohydrate, ash, and moisture. The phytochemical analysis of *C. odorota* leaves showed that it includes steroids, saponins, alkaloids, flavonoids, phytates, cyanogenic glycosides, tannins, oxalate, anthocyanins, and phenols. The results obtained showed that plant phytochemicals present served a critical role in pharmacological advances.

Keywords: *C. odorota*; alkaloids; saponins; phytates; vitamins

Introduction

Chromolaena odorata (*C. odorota)* is one of the herbs that belongs to *Asteraceae,* the sunflower Family, and is also known as *Eupatorium odoratum. It* acts as a traditional medicinal plant. Several parts of this plant are widely used to treat wounds, burns, skin infections, as well as to possess anticancer, antidiabetic, anti-hepatotoxic, antiinflammatory, antimicrobial, and antioxidant properties (Sirinthipaporn and Jiraungkoorskul, 2017). This flowering shrub, native to North America, from Florida and Texas to Mexico and the Caribbean, has been introduced to Asia, West Africa and Australia. Siam weed is of common name for *C. odorota,* grown as a medicinal herb and an ornamental plant. In Indonesia, this plant is one of the important traditional medicines, crushing the young leaves and resulting liquid used to treat skin wounds (Cakraborty *et al.*, 2011). *C. odorota* is also considered a serious weed in plantation crops in the world, such as palm oil plant, coconut, rubber, and citrus. It consists of high allelopathic compounds and suppresses neighbouring vegetation. This weed affects particularly small farms, production in agricultural sectors, and as well as natural ecosystems. *C. odorota*, one of the wound healing plants that has been investigated for its diverse health benefits (Sirinthipaporn and Jiraungkoorskul, 2017). *C. odorota* is found throughout the world, especially in the Pacific region, under different names: Siam weed, devil weed, French weed, hagonoy, co hoy, in Indonesia known as Ki Rinyuh and si koko (Vaisakh and Pandey, 2012). *C. odorota* is being used traditionally for its medicinal properties, especially for external uses as wounds, skin infections, and inflammation. In Indonesia, most people use this plant to cure stomach problems or dyspepsia, reduce cholesterol and hypertension, vertigo, and mainly for external uses as well.

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Material and Methods

Preparation of the Plant Materials

The *C. odorota* leaves were collected at Science Village, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria. It was identified at the Botany Department of Nnamdi Azikiwe University by a taxonomist named Mr Iroka Finian; the herbarium number is NAUH–73[D]. The leaves of *C. odorota* were washed and dried at room temperature and ground into fine powder using a corona blender. The samples were sent to Docchy Laboratory and Research, Awka, Anambra State, Nigeria (fully licensed) for Phytochemical, Proximate, Vitamin, and Mineral content.

Phytate contents: Phytate contents were determined using the method of Young and Greaves (1940) as adopted by LucasMarkakes (1975). 0.2g of each of the differently processed corns was weighed into different 250ml conical flasks. Each sample was soaked in 100ml of 2% concentrated HCL for 3hr, the sample was then filtered. 50ml of each filtrate was placed in a 250ml beaker, and 100ml of distilled water was added to each sample. 10ml of 0.3% ammonium thiocyanate solution was added as an indicator and titrated with standard iron (111) chloride solution, which contained 0.00195g of iron per 1ml.

Vitamin B_{12}: Spectrophotometric determination of cyanocobalamine in serum preparations by coupling reactions with pyridine

Vitamin C: Vitamin C was analysed by the spectrophotometric method described by Roe and Keuther (1943). The ascorbate is converted into dehydroascorbate on treatment with activated charcoal, which reacts with 2,4-dinitrophenyl hydrazine to form osazones. These osazones produce an orange coloured solution when dissolved in sulphuric acid, whose absorbance can be measured spectrophotometrically at 540nm.

Phenol determination: The quantity of phenol was determined using the spectrophotometer method. The plant sample was boiled with 50ml of $(CH_3CH_2)_20$ for 15min. 5ml of the boiled sample is then pipette into a 50ml flask, and 10ml of distilled water is added. After the addition of distilled water, 2ml of NH_4OH solution and 5ml of concentrated $CH_3(CH_2)_3CH_2OH$ are added to the mixture. The samples are made up to the mark and left for 30 minutes to react for color development and measured at 505nm wavelength using a spectrophotometer.

Alkaloids determination: Five grams (5g) of the sample was weighed into a 250ml beaker and 200ml of 20% acetic acid in ethanol was added, covered, and allowed to stand for 4 hours at 25^0c. This was filtered with filter paper No. 42, and the filtrate was concentrated using a water bath (Memmert) to one-quarter of the original volume. Concentrated ammonium hydroxide was added dropwise to the extract until the precipitate was complete. The whole solution was allowed to settle and the precipitate was collected and washed with dilute NH_4OH (1% ammonia solution). Then, filter with pre-weighed filter paper. The residue on the filter paper is the alkaloid, which was dried in the oven (precision electrothermal model BNP 9052, England) at 80^0c. The alkaloid content was calculated and expressed as a percentage of the weight of the sample analyzed (Harborne, 1993; Obadoni and Ochuka, 2001).

Determination of saponin: Five grams (5g) of the sample was put into 20% acetic acid in ethanol and allowed to stand in a water bath at 50^0c for 24hours. This was filtered, and the extract was concentrated using a water bath to one-quarter of the original volume. Concentrated NH_4OH was added drop-wise to the extract until the precipitate was complete. The whole solution was allowed to settle and the precipitate was collected by filtration and weighed. The saponin content was weighed and calculated in percentage (Obadoni and Ochuko, 2001).

Flavonoids determination: Ten grams (10g) of the plant sample was extracted repeatedly with 100ml of 80% aqueous methanol at room temperature. The whole solution was filtered through Whatman filter paper No. 42 (125mm). The filtrate was later transferred into a crucible and evaporated to dryness over a water bath and weighed to a constant weight (Boham and Kocipai, 1994).

Mineral analysis: Heavy metal analysis was conducted using an Agilent FS240AA Atomic Absorption Spectrophotometer according to the method of APHA 1995 (American Public Health

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Association). The atomic absorption spectrometer's working principle is based on the sample being aspirated into the flame and atomized when the AAS's light beam is directed through the flame into the monochromator, and onto the detector that measures the amount of light absorbed by the atomized element in the flame. Since metals have their characteristic absorption wavelength, a source lamp composed of that element is used, making the method relatively free from spectral radiational interferences. The amount of energy of the characteristic wavelength absorbed in the flame is proportional to the concentration of the element in the sample.

Results and Discussions

The results of the phytochemical analysis showed the presence of alkaloids, flavonoids, saponins, phytates, cyanogenic glycosides, tannins, oxalates, anthocyanins, steroids, phenols, and hemagglutinin in C. odorota. The results showed that saponins was highest occurring in the leaves (19.283 ± 0.00), followed by alkaloids, flavonoids, anthocyanins, steroids, tannins, phytates, phenols, with the respective value of 16.820 ± 0.00, 3.631 ± 0.00, 2.685 ± 0.00, 1.653 ± 0.00, 1.062 ± 0.00, 0.713 ± 0.00 and 0.541 ± 0.00(Table 1). At the same time, oxalate was found to be the lowest occurring in the leaves. The proximate analysis of *C. odorota* showed that carbohydrates are the most abundant nutrient, followed by moisture, ash, and fat in that order. The sample has moderate fibre and protein (Table 2). In the result, it was found that the highest occurring vitamins are vitamin C followed by vitamin A, vitamin D, and vitamin E, while moderately low in vitamin B as shown in Table 3. In the mineral analysis, it was found that sodium occurred at the highest (7.676), followed by calcium, potassium, magnesium, and zinc; in contrast, silicon and nickel were found to be the lowest, and no aluminum was present in the leaves, as seen in Table 4.

Table 1. The result of the phytochemical constituents of the leaves of *C. odorota.*

Phytochemicals (%)	***Chromolaema odorata***
Alkaloids	16.820 ± 0.00
Flavonoids	3.631 ± 0.00
Saponins	19.283 ± 0.00
Phytates	0.713 ± 0.00
Cyanogenic glycosides	0.335 ± 0.00
Tannin	1.062 ± 0.00
Oxalate	0.042 ± 0.00
Anthocyanin	2.685 ± 0.00
Steroid	1.653 ± 0.00
Phenol	0.541 ± 0.00
Heamaglutin	0.196 ± 0.00

Table 2. The result of the proximate composition of *Chromolaema odorota.*

Proximate (g/100g)	***Chromolaema odorata***
Ash Content	11.93 ± 0.00
Moisture Content	14.38 ± 0.00
Fat Content	10.75 ± 0.00
Fibre Content	8.52 ± 0.00
Protein Content	10.50 ± 0.00

 doi:10.20944/preprints202509.1288.v1

Carbohydrate Content	43.93 ± 0.00

Table 3. The result of the vitamins analysis in *Chromolaema odorota* leaves.

Samples	Concentration (mg/100g)
Vitamin A	56.319
Vitamin E	8.745
Vitamin C	73.467
Vitamin D	28.770
Vitamin B1	0.179
Vitamins B2	0.1534
Vitamin B3	0.488
Vitamin B6	0.257
Vitamin B12	2.599

Table 4. The result of mineral composition of the *Chromolaema odorota* leaves**.**

Sample	**Mineral (ppm)**
Copper	0.1579
Zinc	0.564
Iron	1.422
Manganese	0.343
Lead	0.0198
Molybdenum	0.067
Arsenic	0.00
Cobalt	0.056
Cadmium	0.022
Magnesium	3.787
Sodium	7.676
Calcium	5.098
Potassium	4.267
Mercury	0.022

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Selenium	0.178
Aluminum	0.00
Nickel	0.1186
Silicon	0.011

The phytochemical screening of *C.odorata* indicates the high presence of saponin, which justifies the cholesterol-lowering properties of *C.odorota* as reported in a study by Nwankpa et al. (2012). The presence of secondary metabolites such as alkaloids, saponins, tannins, and flavonoids attests to its medicinal values (UsunobunandEwere,2016). *C. odorota* leaves contained several flavonoids with anti-adipogenic effects against lipid accumulation in 3T3-L1 adipocytes (Kumkarnjana *et al*, 2018). The high moisture content in *C.odorota* may have a short shelf life; the biological effects attributed to *C.odorota* can be ascribed to the presence of reasonable amounts of bioactive compounds such as alkaloids, flavonoids, phenolics, saponins, steroids, and tannins can be factors causing various biological and health benefits derived from *C. odorota* (Tiamiyu and Okunlade, 2020).

In proximate analysis, ash content is a crucial parameter for determining the nutritional value, quality, and stability of the powdered leaves of C. odorata. It refers to the minerals and inorganic components of the powdered leaves of *C. odorota* left after heating to a very high temperature of 600 °C. The process of heating removes the volatile, organic, and moisture components in the powdered leaves, leaving inorganic components, such as calcium, magnesium, sodium, and potassium (Odion *et al*, 2023). The high carbohydrate content of *C. odorota* shows that the leaves can be a good source of energy when consumed or used as a vegetable in food (Achara and Ifemeje, 2025).

The vitamin C of *C.odorata* leaves (73 mg/100 g) was found to be higher than that of Carica papaya leaves (68 mg/100 g) as reported by Nwamarah et al. (2019). This represents an increase of approximately 7.35% in vitamin C content. *C. odorota* possesses a significant amount of vitamin A, which plays a role in maintaining healthy skin. Vitamin D has other roles in the body, including the reduction of inflammation as well as modulation of processes such as cell growth, neuromuscular and immune function, and glucose metabolism (Jones et al., 2014), which can be associated with the amount of vitamin D *C. odorota* possesses.

Nickel assumes significance in the production of red blood cells, iron absorption, enhancement of bone strength, and glucose metabolism (Kumar *et al*, 2016). Importantly, this study unveiled the presence of nickel as an element in C. odorota. Nickel composition of *C. odorota* is high compared to that of *C. papaya* (Okon *et al*, 2017), but *C. odorota* is relatively low in potassium when compared with *C. papaya.* The absence of aluminum in *Chromolaena odorata* suggests that this plant does not accumulate aluminum in its tissues. This is significant because it indicates a potential difference in how *C. odorota* interacts with certain metals compared to other plants. Specifically, it suggests that *C. odorota* may not be an aluminum accumulator, which could be relevant in phytoremediation strategies or in understanding the plant's ecological role in different soil types.

Conclusion

Chromolaena odorata leaves are rich in a variety of phytochemicals and essential nutrients, highlighting their potential as a valuable medicinal and nutritional resource. The phytochemical content, such as flavonoids, tannins, alkaloids, saponins, and phenols, suggests strong antioxidant, anti-inflammatory, and antimicrobial potentials, supporting the plant's traditional medicinal use.

References

1. A. Jilani, B. Legseir, R. Soulimani, A. Dicko, and C. Younos, "New extraction technique for alkaloids," *Journal of the Brazilian Chemical Society*, Vol. 17, 2006.

 doi:10.20944/preprints202509.1288.v1

2. A. K. Patra and J. Saxena, "Exploitation of dietary tannins to improve rumen metabolism and ruminant nutrition," *Journal of the Science of Food and Agriculture*, Vol. 91, Issue 1, Jan. 2011, pp. 24–37.
3. A. Sofowora, "Guidelines for research promotion and development in traditional medicine," *Nigerian Journal of Pharmacy*, Vol. 11, 1980, pp. 117–118.
4. D. Pathak, K. Alam, H. Rohilla, and A. Agarwal, "Phytochemical investigation of Boerhavia diffusa and Andrographis paniculata: A comparative study," *International Journal of Pharmaceutical Sciences*, Vol. 4, 2012, pp. 250–262.
5. E. E. Odion, D. A. Ambé, P. D. O. Idiakose, and F. E. Odiete, "Criblage phytochimique, analyse proximale et analyse chromatographique de l'extrait foliaire au méthanol de *Chromolaena odorata* (L.) M. King & H. R. Rob. (Astéracées)," West African Journal of Pharmacy, vol. 34, no. 2, pp. 44–54, 2023.
6. G. Jones, "Vitamin D," in Modern Nutrition in Health and Disease, 11th ed., A. C. Ross, B. Caballero, R. J. Cousins, K. L. Tucker, and T. R. Ziegler, Eds. Philadelphia: Lippincott Williams & Wilkins, 2014.
7. H. Pandith, X. Zhang, J. Liggett, K. W. Min, W. Gritsanapan, and S. J. Baek, "Hemostatic and wound healing properties *of C. odorota* leaf extract," *Improvement Science Research Network Dermatology*, 2013, pp. 168–269.
8. I. A. Aboagye, M. Oba, K. M. Koenig, G. Y. Zhao, and K. A. Beauchemin, "Use of gallic acid and hydrolyzable tannins to reduce methane emission and nitrogen excretion in beef cattle fed a diet containing alfalfa silage," *Journal of Animal Science*, Vol. 97, Issue 5, 2019, pp. 2230–2244.
9. J. U. Nwamarah, A. R. Ade, and T. J. Asogwa, "Nutrient composition of Carica papaya leaves extracts," Journal of Food Science and Nutrition Research, vol. 2, no. 3, pp. 274–282, 2019.
10. M. N. Vaisakh and A. Pandey, "Pharmacognostic study of leaves of C. odorota," UNM International Journal of Pharmaceutical Research and Development (IJPRD), 2012.
11. N. I. Achara, A. C. Nwaka, J. C. Ifemeje, O. C. Ezeigwe, and R. S. Ebugosi, "Ameliorative effect of *Chromolaena odorata* on liver and kidney function parameters of acetaminophen-induced toxicity in rats," International Journal of Biochemistry Research & Review, vol. 34, no. 4, pp. 104–121, 2025.
12. P. Puwastien, T. E. Siong, J. Kantasubrata, G. Craven, R. R. Feliciano, and K. Judprasong, "ASEAN Manual of Food Analysis," *Institute of Nutrition, Mahidol University*, 2011.
13. S. A. Johari, L. S. Kiong, M. Mohtar, M. M. Isa, S. Man, and S. Mustafa, "Efflux inhibitory activity of flavonoids from *C. odorota* against selected methicillin-resistant Staphylococcus aureus (MRSA) isolates," *African Journal of Microbiology Research*, Vol. 6, 2012, pp. 5631–5635.
14. S. Hanphanphoom and S. Krajangsang, "Antimicrobial activity of *C. odorota* extracts against bacterial human skin infections," *Modern Applied Science*, Vol. 10, Issue 2, 2016, p. 159.
15. S. Kumar and A. V. Trivedi, "A review on role of nickel in the biological system," International Journal of Current Microbiology and Applied Sciences, vol. 5, no. 3, pp. 719–727, 2016.
16. S. Kumkarnjana, R. Suttisri, U. Nimmannit, T. Koobkokkruad, C. Pattamadilok, and N. Vardhanabhuti, "Anti-adipogenic effect of flavonoids from Chromolaena odorata leaves in 3T3-L1 adipocytes," Journal of Integrative Medicine, vol. 16, no. 6, pp. 427–434, 2018.
17. T. C. Thoden, M. Boppre, and J. Hallmann, "Pyrrolizidine alkaloids of *C. odorota* act as nematicidal agents and reduce infection of lettuce roots by Meloidogyne incognita," *Nematology*, Vol. 9, 2007, pp. 343–349.
18. U. Usunobun and G. E. Ewere, "Phytochemical analysis, mineral composition and in vitro antioxidant activities of *Chromolaena odorata* leaves," ARC Journal of Pharmaceutical Sciences (AJPS), vol. 2, no. 2, pp. 16–20, 2016.
19. W. I. Okon, A. I. Ogri, and G. O. Igile, "Nutritional quality of raw and processed unripe *Carica papaya* fruit pulp and its contribution to dietary diversity and food security in some peasant communities in Nigeria," International Journal of Biological and Chemical Sciences, vol. 11, no. 3, pp. 1000–1008, 2017.