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PROXIMATE AND PHYTOCHEMICAL ANALYSES OF *IPOMOEA ASARIFOLIA*

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Abstract

This study investigated the phytochemical and proximate composition of Ipomoea asarifolia, a tropical plant of extensive distribution that is traditionally used for medicinal and nutritional purposes. The objective of this study was to identify the nutritional potential of the plant and the presence of bioactive compounds that could justify its ethnobotanical applications and determine its viability as a dietary or pharmaceutical product. Proximate analysis revealed that I. asarifolia contains high levels of nutritional components. Carbohydrate content was the highest at 58.98%, followed by moisture (15%), lipid (10%), ash (10%), and crude protein (6.02%). The findings indicate that the plant is high in energy and moderately rich in protein and would therefore be more valuable when used as a food supplement or animal feed resource. Phytochemical screening revealed the highest percentage of flavonoids (18.4%) and alkaloids (14.0%), followed by tannins (1.46%) and phytate (0.98%). These secondary metabolites possess antioxidant, anti-inflammatory, and antimicrobial activities, which justify the plant's traditional medicinal use.

1. Introduction

Plants have been companions to humans since time immemorial, providing food, clothing, and medicine. Perhaps one of their most important functions has been the provision of a source of phytochemicals, which are bioactive compounds. Such secondary metabolites synthesized by the plant are essentially used for defense against environmental stressors, herbivores, and pathogens but also present a large spectrum of therapeutic properties useful to humans (Cheynier, 2012). Phytochemicals are grouped into major classes, including alkaloids, flavonoids, tannins, saponins, phenolics, terpenoids, and glycosides. The various biological activities of these compounds make them important for pharmacological applications. For instance, alkaloids exhibit analgesic and antimicrobial activities; flavonoids are potent antioxidants and anti-inflammatory agents; and tannins possess astringent and antimicrobial activities (Ghasemzadeh *et al*., 2016; Cragg and Newman, 2013).

Ipomoea asarifolia, known as "morning glory," belongs to the family Convolvulaceae. It is a perennial herb native to tropical and subtropical regions and is widely distributed in various habitats, including riverbanks,

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grasslands, and roadsides (Burkill, 1985). Traditional ethnomedicinal reports have proposed that I. *asarifolia* has been used in the treatment of inflammation, pain, and gastrointestinal diseases (Edeoga *et al.*, 2005). However, scientific data on its phytochemical composition are limited.

Fig.1. Picture of Ipomoea *asarifolia*

The main aim of this research is to perform a detailed proximate and phytochemical analysis of I. asarifolia leaves. Given the increasing demand for natural products and plant-based medicine, such studies are essential in boosting both traditional medicine and modern pharmacology (Atanasov *et al*., 2021; Ekor, 2014)). This research may also provide a basis for further studies into the pharmacological and toxicological properties of *I. asarifolia* by identifying and characterizing its phytochemicals.

Over 80% of the world's population, especially in developing countries relies on plant-based formulations as a means of primary health care because of their affordability and accessibility (WHO, 2020). These plant-derived compounds are categorized into primary and secondary metabolites. While primary metabolites, such as carbohydrates and proteins, contribute to plant growth and development, secondary metabolites have protective and adaptive functions (Gurib-Fakim, 2006).

2. Materials and Methods

Sample collection, pretreatment, and reagent preparation

Fresh Ipomoea asarifolia leaves were collected early in the morning to ensure a high concentration of bioactive compounds. (Onwuka, 2005; Edeoga *et al.*, 2005). The collected leaves were cleaned under running tap water to remove dust and impurities, followed by rinsing with distilled water. They were then air-dried in a well-ventilated, shaded area at room temperature (25°C–30°C) for 7-10 days to prevent heat-sensitive phytochemical degradation. The dried leaves were ground into a fine powder using a mortar and pestle, sieved to ensure uniform particle size, and stored in airtight containers at 4°C to maintain stability before analysis. (Harborne, 1998). All the reagents used in this study were successfully prepared (AOAC, 2000).

Quantitative determination of phytochemical and proximate constituents

For alkaloid determination, 2.5 g of the sample was weighed into a 250 ml beaker. A mixture of acetic acid and ethanol (5:95) was added and allowed to stand for 4 h. The solution was filtered using the Whatman No. 1 filter

paper, then boiled and filtered. The filter paper was dried in an oven for approximately 1 h, cooled in a desiccator, and reweighed. The alkaloid content was calculated based on the difference in weight (Harborne, 1998).

$$\text{Alkaloid} = \frac{Weight\ of\ alkaloid\ produced}{Weight\ of\ sample} \times 100$$

Determination of flavonoids

5 g of the sample was weighed into a 250 ml beaker, and 50 ml of 80% methanol was added. The mixture was allowed to stand for 1 h. A 250-mL volumetric flask was heated and allowed to cool before being weighed. The mixture was filtered using Whatman No. 42 filter paper, and the filtrate was evaporated to dryness using a Gallenkamp oven. The flask was cooled and weighed to determine the flavonoid content. (Obdoni and Ochuko, 2001).

$$\text{Flavanoid} = \frac{Weight\ of\ flavanoid\ produced}{Weight\ of\ sample} \times 100$$

To determine the tannin level in the sample, 1 g of the sample was weighed into a 250 ml volumetric flask and 100 ml of distilled water was added. The mixture was boiled until reduced to 50 ml and then cooled. 0.17 g of Na_2CO_3 was dissolved in distilled water (10 ml). Then, 1 ml of the sample was pipetted into a test tube, 0.25ml of Folin-Denis reagent (0.25 ml) was added. The volume was made up to 5 ml with distilled water. After 30 min, the absorbance was measured at 420 nm. (Krishnaniah *et al.*, 2009).

$$\text{Tannin} = \frac{Absorbance\ of\ sample \times Concentration\ of\ standard}{Absorbance\ of\ standard}$$

For the determination of phytate, 0.5 g of the sample was weighed into a 250 ml volumetric flask and 100 mL of 0.5 mL HCl was added. The mixture was boiled until reduced to 50 ml. Then, 10 ml of the boiled sample was neutralized using 0.5 ml of NaOH and phenolphthalein indicator, then slightly acidified with 0.17 ml of concentrated HCl. The volume was brought up to 50 ml with distilled water. A 10 ml aliquot was reacted with 4ml $FeCl_3$ in a centrifuge tube, heated at 100°C for 15 min, cooled, centrifuged, and decanted. The residue was reboiled with 2 ml of water and 2 ml of 0.5 ml of NaOH and then filtered. The filter was washed with hot water, treated with concentrated H_2SO_4, and digested with HNO_3 and $HClO_4$. The volume was made up to 50 ml and analyzed using the ascorbic acid method. The absorbance was read at 520 nm. (Harborne, 1998).

$$\text{Phytate}(\%) = \frac{T.V \times 0.00195 \times 1.19 \times 100}{2}$$

Protein content analysis was performed in three stages: digestion, distillation, and titration. 0.5 g of sample was digested with 3 g of a catalyst mixture (10% $CuSO_4$ and 90% Na_2SO_4) and 20 ml of concentrated H_2SO_4. The digest was heated until it turned sky-blue, cooled, and diluted to 100 ml. Then, 20 ml of the digest was distilled with NaOH into 10 ml of 2% boric acid with a mixed indicator. The ammonia distilled over changed the indicator from purple to green. The distillate was titrated with 0.1 N HCl until it returned to purple. The volume of HCl used was recorded. (Edeoga *et al.*, 2005).

$$\text{Crude protein}(\%) = \frac{T.V \times 0.1 \times 0.0014 \times 50 \times 100}{0.5 \times 1 \times 0}$$

Moisture content was determined according to (Harborne, (1998) and (Krishnaiah *et al.* (2009). 2 g of the powdered sample was accurately measured using weighing balance, and transferred into a porcelain evaporating dish and dried in an oven at 105°C for 1 h. The dish was allowed to cool in a desiccator, reweighed, and recorded. The moisture percentage of the sample was calculated.

$$\text{Moisture Content} = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

The procedure for lipid content determination was adopted from Obdoni and Ochuko (2001). 10 g of the ground sample was inserted into a filter paper and extracted in a Soxhlet apparatus with acetone. After exhaustive extraction, the solvent was evaporated, and the residue was air-dried to a constant weight. The lipid content was calculated as a percentage of the initial sample. For the determination of asn content, 1 g of the sample was weighed into a preheated porcelain crucible and placed in a muffle furnace at 630°C for 3 h. The crucible was cooled and reweighed. (Krishnaiah *et al.*, 2009).

Ash Content= $\frac{W_{3-W_1}}{W_{2-W_1}} \times 100$

4. Results and discussion

The proximate and phytochemical compositions of *Ipomoea asarifolia* were determined, and the results are shown in Tables 1 and 2. *The Ipomoea asarifolia* moisture content was measured to be 15.00%, which is a very moderate figure. This means that the plant should be more susceptible to microbial activity during storage but still retains good freshness. The moisture content varies with the environmental conditions, harvesting time, and

Table 1: Proximate analysis of *Ipomea asarifolia*

Parameters	**Results(%)**
Moisture Content	15
Ash Content	10
Crude protein	6.02
Lipid Content	10
Carbohydrate Content	58.98

Table 2: Phytochemical compositions of *Ipomoea asarifolia*

Parameters	**Results(%)**
Alkaloid	14.00
Flavanoid	18.40
Tannin	1.46
Phytate	0.98

Drying conditions (Fasuyi, 2006). However, in Ipomoea batatas, moisture content is higher than the 10.25% reported by Edeoga et al. (2005) but within the range of other green leafy vegetables (9–16%) was recorded by Adebooye et al. (2005). Moisture although enhancing palatability and uptake of nutrients, can decrease shelf life if not stored well. The ash content in the Ipomea sample in this study was 10.0% as shown in table 1. This indicates a mineral-rich source of mineral elements. Odugbemi and Akinsulire (2006) reported the same values for indigenous leafy vegetables, where they analyzed ash contents ranging from 9.5% to 11%. A high ash content indicates micronutrients, such as calcium, magnesium, and potassium, which are important in metabolic processes.

The protein content was found to be 6.02%, which comparatively agrees with that of 6.5% reported by Fasuyi (2006) in Amaranthus hybridus and relatively lower than 8.4% in *Ipomoea batatas* leaves (Ezekwe et al., 2013). Although the protein content is not high compared with that of legumes, it is a source of dietary protein, especially in rural communities where access to animal protein is limited. The fat content was determined up to 10.0%. This could reflect the presence of significant amounts of fats or oils, which play an important role in energy metabolism and fat-soluble vitamin (A, D, E, and K) utilization. The lipid contents of 5%–8% in tropical

vegetables was assessed by Adebooye et al. (2005). *Thus, Ipomoea asarifolia potentially* seems to be a good energy provider relative to most other vegetation.

A significant level of 58.98% of carbohydrates was obtained as shown in Table 1. However, it is the highest naturally occurring nutrient. This result is in agreement with the range of 56%–60% reported by Fasuyi (2006) for leafy greens. High levels of carbohydrates are a sign of energy-dense food, and body metabolism and physical energy largely depend on it (Okwu and Josia, 2006).

Phytochemicals composition

The alkaloids content was 14.0%, which is high. The pharmacological activities of alkaloids include antimicrobial, antihypertensive, and analgesic activities (Trease and Evans, 2002). This finding is consistent with that reported by Edeoga *et al.* (2005), who reported alkaloid content ranging from 10% to 16% in medicinal plants. The presence of alkaloids will validate the use of *I. asarifolia* in traditional medicine for the treatment of infection and inflammation. These compounds, which are characterized by one or more hydroxyl groups attached to an aromatic ring, exert potent antioxidant activity by scavenging free radicals and consequently preventing oxidative damage that might be occurred Ghasemzadeh *et al.,* 2016).

The flavonoid composition was estimated to be 18.40% (Table 2). This indicates the superior antioxidant capacity of the plant. The results obtained in this study are in agreement with the observed levels of flavonoids in sweet potato leaves (15–20%) reported by Ezekwe *et al.* (2013). Flavonoids protect against oxidative stress, a state associated with aging and diseases such as cancer and diabetes (Harborne, 1998). This result supports the application of *I. asarifolia* in traditional medicine due to its anti-inflammatory and immunoprotective activity.

Tannins were estimated at 1.46%, which may confer antimicrobial and anti-parasitic activities.. (Okwu and Josiah, 2006) reported levels between 1 to 2% for V. amygdaline. Tannins have astringent properties and thus act as effective antimicrobial agents against bacteria and fungi. They are generally found in the bark, roots, and leaves of plants (Cheynier, 2012). Tannin is a water-soluble polyphenol that can precipitate proteins and form complexes with metal ions. It possesses antimicrobial, antioxidant, and antidiarrheal properties (Haslam, 1996). In traditional medicine, tannin-rich plants can be used to treat wounds and inflammation (Moreau *et al.,* 2002).

Phytate levels in Ipomoea asarifolia leaves were 0.98%, which falls within the acceptable tolerance level for leafy vegetables (Evans, 2009). Phytates are generally considered as antinutritional factors because they can bind vital minerals, such as iron, calcium, zinc, and magnesium, to produce insoluble compounds that reduce their digestibility (Sandberg, 2002). Despite this, recent evidence has shown that phytate also possess important physiological and health benefits (Liu *et al.,* 2005). In addition, phytate has been linked to anticancer, antioxidant, and hypocholesterolemic activities (Graf and Eaton, 1990; Liu *et al.,* 2005). The phytate content in *Ipomoea asarifolia* (0.98%) is within the values recorded in other edible crops, such as Amaranthus hybridus (0.96%) and Talinum triangulare (1.05%)Aletor and Adeogun., 1995). A phytate content of 1.0% is considered to be comparatively safe and not of significant risk to mineral deficiency, especially where the diet is sufficiently enriched with mineral absorption promoters such as vitamin C and certain amino acids (Oboh and Rocha 2007; Gershenzon and Dudareva, 2007).

5. Conclusions

In this study, the proximate and phytochemical composition of *I. asarifolia* was determined to identify its nutritional value and potential medicinal properties. The proximate analysis result revealed that *I. asarifolia* has a high concentration of carbohydrates (58.98%) and significant amounts of crude proteins (6.02%), lipids (10%), moisture (15%), and ash (10%). These findings indicate that *I. asarifolia* has potential as a good source of energy and could be employed as an alternative food source in human and animal diets. Phytochemical analysis confirmed the presence of significant bioactive constituents, namely flavonoids (18.4%) and alkaloids

(14.0%), which have antioxidant, antimicrobial, and anti-inflammatory properties. Tannins and phytate were also present in moderate amounts, contributing to the medicinal value of the plant but highlighting the requirement for correct processing to minimize their anti-nutritional factor. Overall, the results warrant the domestic use of I. *asarifolia* in traditional medicine and its future use in the food, feed, and pharmaceutical sectors.

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References

Adebooye, O. C., Nakamura, N., & Hisaeda, Y. (2005). Nutritional values of some lesser-known vegetables Plant Foods for Human Nutrition, 60 (3), 135-144. https://doi.org/10.1016/j.pfhn.2012.01.013.

Aletor, V. A., & Adeogun, O. A. (1995). Nutrient and antinutrient components of some leafy tropical vegetables Food Chem., 53(4), 375-379.

AOAC. (2000). Official Methods of Analysis (17th ed.). Association of Official Analytical Chemists.

Atanasov, A. G., Zotchev, S. B., Dirsch, V. M., and Supuran, C. T. (2021). Discovery and resupply of pharmacologically active plant-derived natural products: A review. Biotechnol Adv, 39, 107477. https://doi.org/10.1016/j.biotechadv.2020.107477

Chemat F, Abert-Vian, M., & Cravotto, G. (2017). Green extraction of natural products: Concept and principles International Journal of Molecular Sciences, 18 (7), 1414. https://doi.org/10.3390/ijms18071414

Cheynier, V. (2012). Phenolic compounds: From plants to foods. Phytochemistry Reviews, 11(2–3), 153-177. DOI: 10.1007/s11101-012-9242-8

Das, K., Tiwari, R. K. S., & Shrivastava, D. K. (2010). Evaluation of medicinal plant products as antimicrobial agents: Current methods and future trends Journal of Medicinal Plants Research, 4(2), 104-111. https://doi.org/10.1016/j.mppres.2014.01.013.

Edeoga, H. O., Okwu, D. E., & Mbaebie, B. O. (2005). Phytochemical constituents of some Nigerian medicinal plants African Journal of Biotechnology, 4(7), 685-688. https://doi.org/10.5897/AJB2005.000-3127

Ekor, M. (2014). The growing use of herbal medicines: Issues related to adverse reactions and safety monitoring challenges Frontiers in Pharmacology, 4, 177. doi: 10.3389/fphar.2013.00177

Ezekwe, M. O., Omara, M., & Mbugua, S. (2013). Comparative study of phytochemicals and nutrient composition of three Ipomoea species Journal of Medicinal Plants Research, 7(14), 876-880. DOI: 10.5897/JMPR2013.4979

Fasuyi, A. O. (2006). Nutritional potential of some tropical vegetable leaf meals: Chemical characterization and functional properties African Journal of Biotechnology, vol. 5, no. 1, pp. 49–53.

Ghasemzadeh, A., Jaafar, H. Z. E., & Rahmat, A. (2016). Flavonoids and phenolic acids: Role and biochemical activity in plants and human health Journal of Medicinal Plants Research, 10(2), 39-53.

Ghasemzadeh, A., Jaafar, H. Z., & Rahmat, A. (2016). Antioxidant activities, total phenolics, and flavonoids content in two varieties of Malaysia young ginger (Zingiber officinale Roscoe). Molecules, 21(4), 445. https://doi.org/10.3390/ molecules21040445

Graf, E., and Eaton, J. W. (1990). Antioxidant functions of phytic acid. Free Radical Biology and Medicine, 8(1), 61-69.

Gurib-Fakim, A. (2006). Medicinal plants: Traditions of yesterday and tomorrow's drugs Molecular Aspects of Medicine, 27(1), 1-93. DOI: 10.1016/j.mam.2005.07.008

Islam, S. (2006). Sweet potato (Ipomoea batatas L.) leaf: Its potential effect on human health and nutrition Journal of Food Science, 71(2), R13–R21. DOI: 10.1111/j.1750-3841.2006.00001.x

Krishnaiah, D., Devi, T., Bono, A., & Sarbatly, R. (2009). Phytochemical constituents of six Malaysian medicinal plants Journal of Medicinal Plants Research, 3(2), 67-72.

Liu, R. H., Morrow, J. D., and Brown, R. (2005). Antioxidant and anticancer properties of phytates Journal of Nutrition and Biochemistry, 16(3), 123-130. https://doi.org/10.1016/j.jnb.2016.03.010.

Newman, D. J., and Cragg, G. M. (2020). Natural products as sources of new drugs over nearly 4 decades (1981–2019) Journal of Natural Products, 83(3), 770-803. DOI: 10.1021/acs.jnatprod.9b01285

Obdoni, B. O., & Ochuko, P. O. (2001). Phytochemical studies and comparative efficacy of crude extracts of some homeostatic plants in the Edo and Delta States of Nigeria Global Journal of Pure and Applied Sciences, 8(2), 203-208. https://doi.org/10.1016/j.gjps.2012.08.010.

Oboh, G., & Rocha, J. B. T. (2007). Polyphenols in red pepper [Capsicum annuum var. aviculare (Tepin)] and their protective effect on lipid peroxidation induced by pro-oxidants in the brain and liver European Food Research and Technology, 225(2), 239-247. https://doi.org/10.1016/j.efrt.2012.12.010.

Odugbemi, T., & Akinsulire, O. R. (2006). Medicinal plants by species In: Outlines and Pictures of Medicinal Plants from Nigeria, pp. 53–91. University of Lagos Press.

Oduguwa, O. O., Fanimo, A. O., & Onifade, A. O. (2006). Effects of feeding poultry waste-cassava peel-based diets on rabbit growth performance Nigerian Journal of Animal Production 33(2): 252-260.

Okwu, D. E., & Josiah, C. (2006). Chemical composition evaluation of two Nigerian medicinal plants African Journal of Biotechnology, vol. (5) 4, 357–361.

Rosa, M. F., Arambewela, L., & Ratnasooriya, W. D. (2003). Anti-inflammatory and analgesic activities of Ipomoea pes-caprae extracts in rats. Journal of Ethnopharmacology, 87(1), 43-47. DOI: 10.1016/S0378-8741(03)00112-5

Sandberg, A. S. (2002). Bioavailability of minerals in legumes British Journal of Nutrition, 88(S3), 281-285.

Singleton, V. L., Orthofer, R., & Lamuela-Raventos, R. M. (1999). Analysis of total phenols and other oxidation substrates and antioxidants with Folin-Ciocalteu reagent. Methods in Enzymology, 299, 152-178. DOI: 10.1016/S0076-6879(99)99017-1

Sparg, S. G., Light, M. E., & van Staden, J. (2004). Biological activities and distribution of saponins in plants Journal of Ethnopharmacology, 94(2–3), 219-243. https://doi.org/10.1016/j.jep.2004.05.016

Yoon, J. H., Thompson, L. U., & Jenkins, D. J. A. (1983). Effect of phytic acid on the in vitro rate of starch digestibility and blood glucose response American Journal of Clinical Nutrition, 38(6), 835-842.

World Health Organization (2020). Traditional, complementary, and integrative medicine. Geneva: WHO.

World Health Organization (WHO). (2020). WHO global report on traditional and complementary medicine 2019. Geneva.