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Assessing Nutritional Potentials of Wild Edible Leafy Vegetables (*Anogeissus Leiocarpus* and *Lapidium Sativum)* In Zuru Emirate, Kebbi State, Nigeria

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Abstract

This study investigates the nutritional potentials of two wild edible leafy vegetables (Anogeissus leiocarpus and Lepidium sativum) collected from the Danko-Wasagu Area of Zuru Emirate, Kebbi State, Nigeria. Minerals, nutrients, and secondary metabolites were identified using standard analytical techniques. A phytochemical test's findings verified that A. leiocarpus had alkaloids, terpenes, flavonoids, tannins, saponins, steroids, and glycosides, whereas L. sativum's leaf extract samples contained alkaloids, terpenes, flavonoids, tannins, steroids, and glycosides. The vegetables under test had very good levels of nutrients, including protein, fibre, carbohydrates, ash, and moisture content, all of which were comparatively high in L. sativum. The moderate mineral compositions of Ca, P, K, Mg, Fe, and Zn were within the allowable range. In trace and moderate levels, the anti-nutrients oxalate, phytate, cyanide, and tannins were found. Useful minerals and anti-nutritive elements are abundant in Anogeissus leiocarpus and Lepidium sativum. However, the quantity of anti-nutritional components identified in this study is below the hazardous threshold that people can ingest. Therefore, in order to assist people in satisfying their dietary needs, our society should encourage their consumption at all ages. **Keywords:** Anogeissus leiocarpus, Lepidium sativum, edible, wild, leafy, Vegetables, Nutritional potentials.

Introduction: For a very long time, plants have played a very important role in human life. Some of these plants are edible wild plants that humans use as food and nutrient sources. They supply some of the minerals needed to develop muscle and control certain bodily processes (Muhammad, Dangoggo, Tsafe, Itodo and Atiku, 2011). Due to a lack of knowledge about their composition, many plants with potential nutritional properties that could support growth are underutilized. According to Afolayan and Jimoh (2019), these plants are even more tolerant, adaptable, and resilient to unfavorable weather conditions. Usually growing between 15 and 18 meters, this tree can reach a height of 30 meters and has light green leaves. The trunk's base is broader and sometimes striped. Its limbs frequently droop, and its crown is massive. The bark is fibrous with thin scales, and its colour changes from grey to blackish as it ages. It features elliptical to oval, alternately subopposite leaves that are 2–8 cm long and 1.5–3.5 cm broad, along with delicately pubescent stems (Arbonnier 2014). The base of the leaves is cuneate, while the apex is acuminate or micronate. Growing in dry regions, the petiole is 1-6 mm long and typically has smaller leaves and hairier blooms. A terminal, axillary, spherical cluster makes up the inflorescence. Bisexual and apetalous, the flowers have a yellow-green fragrance. As an anthelmintic for humans and livestock, the inner bark of the tree is used to cure worms and a few protozoan infections in animals, such as babesiosis and Nangana, an animal trypanosomiasis (Jibril and Ojo, 2016). The inner bark has antimicrobial qualities, and in Nigeria, it is used as a chewing stick. Castalagin and dilactone of flavogallonic acid are found in the stem bark (Sadiq, 2019).

Lepidium sativum, also known as Lansir in Hausa, is frequently termed garden cress or curly cress (Bloukh, Edis, Sara and Alhamaidah, 2021). With the genus of sativum of the *Lepidium sativum* species, it is a member of the division of angiosperms and the kingdom of plantae, which is a subclass of angiosperms and a native family of brassicaceae and order of brassicales. The plant shares a peppery, sour flavour and aroma with mustard and watercress, which are genetically linked (Türkoğlu, Kılıç and Pekmezci, 2018). Garden cress is sometimes referred to as mustard and cress, pepperwort, pepper grass, garden pepper cress, or poor man's pepper (Hadi and Hameed, 2017). This annual plant can reach a height of 60 cm (24 inches), with many branches on the upper half. The white to pinkish blooms are only 2 mm (1⁄16 inch) in diameter, grouped in little branched racemes (Türkoğlu *et al*., 2018). According to Rehman, Khan and Alkharfy (2012), it is frequently used in traditional medicine to treat hyperactive airway conditions such as cough, bronchitis, and asthma. Additionally, it is used as a diuretic, antirheumatic, and febrifuge for pain in the abdomen, to mend fractures, and to treat gout. Asthma, pain, inflammation, nociception, blood coagulation, oxidative stress, enuresis, and associated illnesses are among the common medical uses (Rehman *et al*., 2012). Although many of these underutilized wild food plants have been identified, their potential for use has been constrained by a lack of empirical data regarding their chemical makeup (Afolayan and Jimoh, 2019). Vegetables are among these plants that contribute to the recommended daily allowance (RDA) of the important nutrients and are excellent sources of minerals (Bvenura and Sivakumar, 2017). Because they are naturally low in calories and sodium and free of cholesterol, leafy greens are a fantastic choice for a balanced diet. Phytonutrients, special substances that give plants protection, are responsible for many of the health advantages that leafy greens offer. According to Okeno, Chebet and Mathenge (2003), these substances are increasingly acknowledged as components of a wholesome diet that supports long-term health.

Food shortages are becoming apparent in the majority of emerging nations, such as Nigeria, due to poverty, competition for arable land, and population increase (Sadiq, 2019). The cost of available basics has also increased as a result of restrictions on the importing of specific items. The food shortfall is caused by unstable government agricultural policy, a paucity of agricultural inputs, and inadequate lending programs and incentives (Muhammad *et al*., 2011). These lush edible wild plants have been shown to have nutritional value and are valued by consumers as a delicacy in recipes. The nutritional potential of *Lapidium sativum* and *Anogeissus leiocarpus* is investigated in this study. Wild edible vegetables are essential because they give us food to eat every day rather than relying on regular carbohydrate consumption, which can cause severe malnutrition. Furthermore, these vegetables might provide important nutrients and certain bioactive compounds. Even though wild edible veggies are readily available, effective, and reasonably priced, they are still overlooked since there is little qualitative data on the potential of their chemical makeup.

Materials and Methods: Sample collection and identification.:The corresponding author collected the edible leaves of *Angeissus leiocarpa* and *Lepidium sativum* on April 15, 2024, from the Danko-Wasagu Local Government, Zuru Emirate, Kebbi South in Kebbi State, Nigeria. Morphological traits were used to identify and authenticate the plants at the Federal University of Agriculture Zuru's Biology Department in Kebbi State, Nigeria.

Plate 1: Leaf of *Angeissus leiocarpus*

Plate 2: Leaf of *Lepidium sativum*

Preparation of plant extract : The gathered leaves were cleaned, allowed to dry in the shade, ground into uniformly sized powder, and macerated for 72 hours in 70% ethanol (v/v). Cotton wool-filled funnels were used to filter the solutions. To create a semi-dry extract, the filtrates were heated to 400C in a water bath until they evaporated completely. Before being used for phytochemical screening, this was re-suspended in 250 millilitres of distilled water and kept in a 100-millilitre beaker in the refrigerator (Onuwuka, 2005).

Qualitative and quantitative phytochemical screening: The analysis was conducted at Usmanu Danfodiyo University's Laboratory of the Crop Science Department in Sokoto State, Nigeria. Using conventional protocols, chemical tests were performed on the ethanol leaf extract to identify different bioactive components as outlined by the Association of Official Analytical Chemists (AOAC, 2010).

Determination of nutrients, anti-nutrients and minerals compositions: In accordance with AOAC (2004b) and Ahmad, khan and Ansari (2017), the samples were chemically examined for moisture content, protein, fibre, carbohydrate content, and ash content. The techniques of AOAC (2004a) and Onuwuka (2005) were used to measure tannin, oxalate, phytate, and cyanide. Using the atomic absorption spectrophotometric (AAS) method AOAC (2004b), minerals including potassium (K), magnesium (Mg), calcium (Ca), phosphorus (P), zinc (Zn), and iron (Fe) were identified. Three duplicates of each analysis were performed.

Statistical analysis : Statistical Package for Social Science (SPSS) IBM version 20 was used to analyse, summarise, and express the data as mean ± standard error of the mean of replicates. The student t-test was then used for the test of differences. According to Ubom (2004), the probability limit was established at the 95% level of significance (p=0.05).

Results and Discussion

A. Qualitative phytochemical of *A. leiocarpus* and *L. sativum*

Table 1: Qualitative phytochemical in leaves extract of *A. leiocarpus* and *L. sativum*

Phytochemical	*A. leiocarpus*	*L. sativum*
Alkaloid	+	++
Terpenoid	+	+
Flavonoid	+	+
Tannin	++	+
Saponin	+	ND
Steroid	++	+
Glycoside	++	++

Key: ***(ND)*** *Not detected;* ***(+)*** *trace,* ***(++)*** *Moderate*

B. Quantitative phytochemical of *A. leiocarpus* and *L. sativum* (Mg/g)

Table 2: Quantitative phytochemical of leaves extract of *A. leiocarpus* and *L. sativum* (Mg/g)

Phytochemical	*A. leiocarpus*	*L. sativum*
Alkaloid	13.33±5.77^{a}	17.87±1.61^{a}
Terpenoid	20.95±0.35^{b}	53.00±0.46^{a}
Flavonoid	11.23±0.25^{a}	4.87±1.17^{a}
Tannin	27.39±0.72^{a}	14.59±0.49^{b}
Saponin	19.05±2.65^{a}	ND
Steroid	10.93±0.31^{b}	20.05±0.32^{a}
Glycoside	6.02±0.14^{a}	5.05±0.44^{a}

KEY: *The data are mean value ± standard deviation of triplicate results. Values with the same superscript on the same row have no significant difference at p<0.05. ND – Not Detected.*

Table 2 of the quantitative phytochemical analysis shows that *L. sativum* had a good amount of terpenoid, steroid, and alkaloid (53.00±0.46 mg/g, 20.05±0.32 mg/g, and 17.87±1.61 mg/g, respectively), while *A. leiocapus* had flavonoid, tannin, saponin, and glycoside concentrations of 11.23±0.25 mg/g, 27.39±0.72 mg/g, 19.05±2.65 mg/g, and 6.02±0.14 mg/g. This suggests that the discoveries might have more promising medicinal applications.

Alkaloids, terpenoids, flavonoids, tannins, saponins, steroids, and glycosides were found in all samples except for saponin, which was not found in *L. sativum*, according to the qualitative results of the phytochemical screening of ethanol leaf extract (Table 1).This result is similar to the findings of Syed, Chamcheu, Adhami, & Mukhtar (2013), where these secondary metabolites were discovered in the aqueous and ethanolic extracts of the leaf, bark, and roots of *A. leicarpus*. According to a previous study by Ayoola, Adeyeye and Onawumi (2010), the plant's leaves are high in tannins and saponins. These active ingredients have been connected to plant antimicrobial qualities (Ayoola *et al*., 2010), specifically the antibacterial activity of *A. leiocarpus* leaf, stem, and root bark extract (Georgiev, Ananga and Tsolova, 2014).Two wild edible leafy vegetables had secondary metabolite concentrations that were considerably (p=0.05) greater than the standard. It has been discovered that these secondary metabolites contain characteristics that make them essential to both plants and mammals. With the exception of saponin in *L. sativum*, the bioactive substances found include alkaloids, tannins, flavonoids, glycosides, terpenes, and saponins. Kubmarawa, Ajoku, Enworem and Okorie (2007) have reported the significance of alkaloids, tannins, and saponins in a variety of antibiotics used to treat certain pathogenic illnesses. Natural alkaloids contained in plant leaves, bark, roots, and seeds have been shown to work as pain relievers, increase or decrease blood pressure, and activate the neurological system (Ayoola *et al*., 2010). Flavonoids have been shown to have anti-oxidative properties and to protect against liver toxicity, viruses, tumours, ulcers, inflammation, allergies, platelet aggregation, and microorganisms (Syed *et al*., 2013; Georgiev *et al*., 2014). Peristrophe bicalculata contains tannins, flavonoids, and cardiac glycosides that have been shown to have the ability to support haemopoietic indices and replenish blood lost after severe bleeding (Esenowo, Sam, Bala, Ekpo and Edung 2010). Okon, Udosen and Mbong (2013) found similar outcomes with Uvaria chamae root extract. The anti-inflammatory and analgesic properties of vegetables have been verified by terpenes in contemporary clinical research (Singh, 2006). Terpenes have an antiseptic impact on germs, according to Nassiri and Hoaaein (2008). The therapeutic qualities of *S. tragacantha* and *S. indicum* may be partially attributed to the presence of these compounds.

C. Mineral compositions of *A. leiocarpus* and *L. sativum* (mg/100g dry weight)

Table 3: Mineral compositions of leaves extract of *A. leiocarpus* and *L. sativum* (mg/100g dry weight)

Mineral composition	*A. leiocarpus*	*L. sativum*
Calcium (Ca)	11.68±0.44^{a}	13.88±0.75^{a}
Phosphorus (P)	4.29±0.06^{a}	6.10±0.33^{a}
Potassium (K)	6.24±0.59^{b}	13.44±0.93^{a}
Magnesium (Mg)	2.83±0.41^{a}	3.12±0.28^{a}
Iron (Fe)	1.04±0.02^{a}	1.60±0.12^{a}
Zinc (Zn)	0.50±0.11^{a}	0.56±0.14^{a}

Note: *The data are mean value ± standard deviation of triplicate results. Values with the same superscript on the same row have no significant difference at p<0.05.*

Table 4: Proximate analysis of leaves extract of *A. leiocarpus* and *L. sativum* (%)

Composition	*A. leiocarpus*	*L. sativum*
Moisture	16.09±0.57^{b}	93.35±0.77^{a}
Ash	13.12±0.92^{a}	17.33±0.80^{a}
Crude Fibre	21.17±1.86^{b}	8.67±0.67^{b}
Crude Protein	29.25±0.78^{a}	18.67±0.72^{a}
Carbohydrate	10.40±0.10^{a}	16.58±0.24^{a}

Key: *The data are mean value ± standard deviation of triplicate results. Values with the same superscript on the same column have no significant difference at p<0.05.*

Table 3's mineral analysis results showed that *L. sativum* had higher mean scores for all of the minerals that were measured, including Ca (13.88±0.75 mg/100g), P (6.10±0.33 mg/100g), K (13.44±0.93 mg/100g), Mg (3.12±0.28 mg/100g), Fe (1.60±0.12 mg/100g), and Zn (0.56±0.14 mg/100g). The samples (*A. leiocarpus* and *L. sativum*) did not differ statistically significantly (p < 0.05) on any of the minerals, with the exception of potassium. This suggests that the results included a significant quantity of macro- and micronutrients for improved growth and development. Mineral examination of *A. leiocarpus* leaf extract revealed that it has high calcium levels; however, they are within the range that Ibrahim, Abdurahman and Ibrahim (2002) documented for several browsing plants. According to Dicko and Sikena (1991), browse plants typically contain significantly higher levels of calcium and potassium than other minerals. The extract contained moderate amounts of iron, zinc, and magnesium, which seem to be similar to the anthelmintic plant *V. amygdalina* (Ibrahim *et al*., 2002). Nevertheless, the concentrations were lower than those found in other plants, including *K. senegalensis* and *A. africanus*. The mineral concentration was often lower than that of several toxic Nigerian plants described by Abatan, Arowolo, and Olorunsogo (1997), which may further support the extract's safety. In this investigation, both samples had high mineral concentration. The immune system, cognitive development, energy metabolism, and temperature regulation all depend on iron (Fe) (Wardlaw, Hampl and DiSilvestro, 2004). In addition to being necessary for the development and maintenance of bone teeth, calcium and phosphorus can aid in blood clotting, muscle contraction, and cell permeability modulation Magnesium is essential for the production of DNA and RNA during cell division. More so, magnesium is essential for heart and nerve function, increases insulin, and lowers blood pressure by widening arteries and reducing irregular heartbeats. Due to its diuretic properties, potassium (K) has been used to prevent and treat excessive blood pressure (Wardlaw *et al*., 2004). According to Pathak and Kapil (2004), zinc has a significant role in immunity, cellular differentiation and replication, protein synthesis, and sexual roles in fertility.

D. Proximate analysis of *A. leiocarpus* and *L. sativum* (%)

High moisture content (93.35±0.77%) in *L. sativum* indicates the poorest storage benefit, followed by ash content (17.33±0.80%), which indicates a better source of inorganic minerals, and carbohydrate content (16.58±0.24%), according to the results of the proximate analysis, which are displayed in Table 4. *A. leiocarpus* has a crude protein content of 29.25±0.78% and a crude fibre content of 21.17±1.86%, which indicates a significant amount of nutrients for health and energy. The sample means show statistically significant changes in moisture content and crude fibre, but no significant differences in ash, crude protein, or carbohydrates. *A. leiocarpus* and *L. sativum* leaf extracts had a crude protein level of 17.31%, according to their proximate composition. This suggests that in addition to its potential as a medicine, it may supply ruminant cattle with a healthy supply of protein, particularly during the dry season. Moisture, protein, CHO, fibre, ash, and other nutrients were all noticeably (p = 0.05) elevated. In comparison to some wild leafy vegetables, such as *C. hardwicki* (11.9+1.36%) and *Eurya acuminata* (14.72+0.04%), both vegetables have extremely high crude protein contents (18.67±0.72 - 29.25±0.78). Generally speaking, plant-based foods should contain more than 12% of their energy from plants. Protein has been implicated in the synthesis of enzymes and hormones, the regulation of bodily functions, and the maintenance and repair of bodily tissues. The body uses proteins as a primary source of energy and to help create antibodies that help fight infections (Brosnan, 2003).

The study's findings demonstrated that the vegetables were high in protein. Fibre consumption can reduce blood cholesterol and reduce the incidence of coronary heart disease, hypertension, diabetes, and breast and colon cancer, according to Ramula and Rao (2003). The World Health Organization (WHO) advises consuming 22–23 kg of fibre for every 1000 kcal of food consumed, as this is essential for proper digestion and waste removal (Brosnan, 2003). Like commercial veggies, these wild edible vegetables have a respectable quantity of fibre. The primary function of CHO is to generate the energy needed for the body to function normally, particularly for vegetarians. These vegetables are excellent sources of CHO for human consumption due to their high CHO content (Akubugwo, Obasi, Chinyere and Ugbogu 2007). The crude protein content of this plant's nutrients is similar to that of the majority of browsing species found in Nigeria's savanna region, according to Ibrahim *et al*. (2002). In their 2007 paper, Akubugwo *et al*. compared the plant's nutritional content to that of three other browsing species in Nigeria's arid zone, supporting this claim.

E. Anti-nutritional analysis of *A. leiocarpus* and *L. sativum*

Table 5: Anti-nutritional analysis of leaves extract of *A. leiocarpus* and *L. sativum*

Samples	Oxalate	Phytate	Cyanide	Tannin
A. leiocarpus	0.66 ± 0.03[a]	1.94± 0.17[a]	3.47 ± 0.11[b]	28.07 ±0.44[a]
L. sativum	0.35 ± 0.09[a]	0.75 ± 0.25[a]	29.79 ± 0.44[a]	30.72 ± 0.45[a]

Key: *The data are mean value ± standard deviation of triplicate results. Values with the same superscript on the same row have no significant difference at p<0.05*

L. sativum had high levels of tannin (30.72±0.45), cyanide (29.79±0.44), phytate (1.94±0.17), and oxalate (0.66±0.03), as indicated by the anti-nutritional analysis results, which are displayed in Table 5. The cyanide mean scores of the two samples differed significantly, with L. sativum having a higher mean score (29.79±0.44), according to the t-test analysis, even if the other anti-nutritional components did not differ significantly. This suggests that a significant quantity of anti-nutrients that were below the allowable range were present in the data, nonetheless, and that they could not have impeded bioavailability or decreased the degree of nutrient utilisation. Consuming excessive levels of oxalate can result in kidney disease (Hassan and Umar, 2004). Phytate is an anti-nutritional element that prevents the growth of many fruits and vegetables since it is known to reduce the mineral content of fruits and vegetables (Weaver and Kannan, 2002). Because hydrogen cyanide interferes with electron flow in the mitochondria, which stops the body from generating energy, it can be quite harmful if taken in excess (Koldziej and Kiderlen, 2005).

Conclusion: According to the findings of the investigation into the phytochemical and nutritional makeup of the two wild edible leafy vegetables (A. leiocarpus and L. sativum), it can be concluded that there are significant amounts of the vital nutrients required for human health. Alkaloids, flavonoids, terpenoid chemicals, and saponins are among the anti-nutritional elements identified. But there was no saponin in L. sativum. These vegetables therefore include a substantial number of nutrients as well, which could support feeding programs and the development of a composite diet.

Recommendations: The following recommendations were made; Government and other non-governmental organisations should support public education campaigns about the nutritional advantages and biological implications of these wild edible veggies. **;** Additionally, the government ought to support the production and use of these particular wild edible veggies in both urban and rural regions.

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Conflicts of Interest : The authors declare that there is no conflict of interest regarding the publication of this article.

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