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Wild vegetables (*Chenopodium album L*): Ethno pharmacology, phytochemical and nutrient profile

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Abstract
This study investigates the versatile traits of *Chenopodium album* L, also known as Wild Vegetables, a fast-growing plant found in nature with a rich history of culinary and medicinal uses. Investigating the properties of C. album when subjected to different solvents, including methanol and water, to uncover its potential health benefits. Our analyses encompassed the estimation of key phytochemicals such as alkaloids, saponins, flavonoids, and phenol. Additionally, we conducted a comprehensive nutritional assessment, revealing C. album. as a valuable source of energy, proteins, carbohydrates, ascorbic acid, beta carotene, and essential minerals such as potassium, sodium, calcium, phosphorus, and iron. Through biological studies, we illuminated the plant's noteworthy attributes, including antioxidative, anti-inflammatory, anticancer, antipruritic, antidiabetic, and immunomodulatory properties. this study provides an informative synthesis of C. album encompassing its, ethno pharmacological relevance, phytochemical composition, and diverse biological activities. In essence, the findings propose promoting the use of overlooked wild vegetable to enhance nutrition across diverse regions of the district, State cultivating them commercially to create valuable local products. This approach aims to improve the health of the population, elevate rural livelihoods, and positively impact the District and regional economy.

Keywords: *Chenopodium album* L, phytochemical, nutritional profile, ethnopharmacology, biological activities.

1. Introduction
The global challenge of achieving food and nutrition security has become a pressing concern, particularly in light of micronutrient deficiencies affecting around two billion people worldwide (FAO, 2012; Padhan, Biswas, & Panda, 2020) [40, 92] To address this challenge, many countries are shifting towards the development of sustainable food systems that embrace advanced agricultural practices and alternative food sources. In this context, an alternative and intriguing approach to ensuring food security involves exploring the potential of wild plants. Wild plants can play a significant role in alleviating food insecurity and malnutrition, harnessing the historical link between human adaptation, nature, and the utilization of wild plants and animals for sustenance and medicinal purposes.
For centuries, wild vegetables have played a critical role in sustaining human diets, supplying essential micronutrients such as vitamins and minerals, crucial for promoting good health and bolstering immunity against infections. Despite their importance, wild vegetables are often available only seasonally and are prone to spoilage, necessitating the preservation of their essential micronutrients for future use (Negi & Roy, 2000; Negi & Roy, 2001) [87, 86]. Globally, wild plants have historically held a pivotal position in meeting people's nutritional and medicinal requirements. Remarkably, each continent boasts diverse environments that harbor valuable wild edible plants, which often remain underappreciated. Wild plants continue to make substantial contributions to annual dietary intake, often surpassing the proportion provided by cultivated crops (Ogle & Grivetti, 1985) [88]. Among these wild plants, certain varieties are known as 'wild vegetables' and hold a prominent place in the traditional diets of tribal communities worldwide, underscoring the rich diversity of natural resources (Sachin *et al*., 2021) [109]. Wild vegetables in rural areas have emerged as essential contributors to ensuring food security and maintaining the health of local populations (Cavender, 2006) [24] (Pieroni *et al*., 2007) [98].
In the realm of modern agriculture, the focus predominantly revolves around a select few food crops, while a vast array of traditional plant species remains largely unexplored by scientists and food producers (Poonia & Upadhayay, 2015) [101-102].

Among these overlooked wild vegetables, the C. album stands out. The Chenopodium genus encompasses approximately 250 species found across the globe, exhibiting remarkable diversity (J & Galwey, 1984) [56]. In India alone, there are around 21 species of Chenopodium, with some intentionally cultivated as vegetables and others primarily grown for their grains (Yadav *et al*., 2007) [148].

C. album is widespread and often considered a troublesome weed in over 40 crops across 47 countries, particularly affecting cereals, sugarbeet, potatoes, and corn (Holm *et al*., 1977) [53]. Nevertheless, this unassuming weed possesses substantial nutritional value and is edible, making it a valuable wild resource in India (James *et al*., 1993; Devasagayam *et al*., 2004) [1, 32]. Furthermore, several Chenopodium species have been documented in ancient Indian texts such as Ayurveda, Atharva Veda, Charak Samhita, and Sushruta Samhita, highlighting their repository of medicinal properties (Bakshi DNG, Sarma, & Pal, 1999) [12]. In agricultural fields where crops like wheat, barley, mustard, and gram are cultivated, C. album is often considered an unwanted plant (Malik, & Pandita, 1986; Bhattacharjee, 2001) [112, 15]. Interestingly, when grown in cultivated fields, C. album exhibits certain beneficial properties, making it particularly noteworthy for harvest. Notably, C. album has the capacity to accumulate heavy metals from contaminated soils, rendering it valuable for phytoremediation in polluted areas. It contributes to enhancing soil fertility, structure, weed suppression, and reducing soil erosion.

The inclusion of C. album in cereals and legumes presents an opportunity to create nutritionally balanced diets that cater to individuals of all age groups. Additionally, C. album can be creatively integrated into the preparation of fermented foods such as idli, dosa, and bread, expanding its culinary versatility. Furthermore, the plant can be used to develop low-fat, crisp, noodle-like snacks and extruded products when combined with soybean protein isolate, offering a diverse range of dietary options (Singh L, *et al*., 2007) [120]. It is often boiled and mixed with other ingredients to make gruel, roasted and ground for porridge, and utilized in the preparation of fermented and alcoholic beverages (Choudhary & Sharma, 2014) [28].

It's important to note that the optimal time for harvesting C. album as a food or medicinal ingredient is in February when it has a pleasant taste and is rich in bioactive phenolics with high antioxidant activities (Poonia & Upadhayay, July 2015) [101-102]. Raw leaves of C. album contain oxalic acid, which, when consumed in excess, can hinder nutrient absorption. However, when consumed in moderation, these plants offer high nutritional value as vegetables. Cooking has been shown to decrease oxalic acid levels. The oxalic acid content in C. album can vary, ranging from 360 to 2,000 mg per 100 g (Guil JL *et al*., 1996) [48].

C. album known as "Awali Dhawali" in the Bhandara district of Maharashtra, India, has been extensively utilized in traditional medicine (Singh L, *et al*., 2007) [120]. Bhandara is situated between geographical coordinates of 20.5°-21.5° N and 79°-80° E, covering a total geographical area of 3,407 square kilometers. The district is home to various tribal communities, each with unique characteristics depending on their specific locations within the district. Agriculture and related activities form the primary occupation of the residents, who cultivate both rabi and kharif crops. C. album is the most common weed found alongside Rabi crops in this region. While some people use it as a vegetable, others remove it from the field as a weed.

The chemical and nutritional composition of C. album makes it a valuable natural resource that deserves attention for its potential contributions to food security. Despite its historical use, this plant remains relatively understudied by researchers, highlighting the need for comprehensive exploration. Current research efforts are primarily focused on investigating the phytochemical properties of this unassuming yet promising plant (Singh, Singh, & Saxena, 2021) [123].

To harness the full potential of this plant, it is important to understand its chemical composition and nutritional value. Phytochemical screening helps in identifying the presence of various secondary metabolites, such as alkaloids, flavonoids, phenols, terpenoids, and tannins, which contribute to the plant's pharmacological activities. Additionally, the quantification of nutritional components provides insights into the dietary benefits of extract, while the analysis of specific phytocompounds offers valuable information regarding their potential bioactivity. In this context, this study aimed to determine the nutritional value, phytochemical composition, quantities, and biological properties of C Album in the future, we could grow and consume C. album as a nutritious food and use it to develop novel medicines to tackle various health challenges.

2. Materials and Methods

2.1 Chemicals

Folin-Ciocalteu's Phenol reagent (LOBA Chem), Sodium carbonate (LOBA Chem), Gallic acid (LOBA Chem), Aluminium chloride (LOBA Chem), Ethanol (KR), Quercitin (TCI), potassium acetate (LOBA Chem), Sodium Chloride (LOBA Chem), Biuret reagent, Tannic acid (Oxford lab), Folin-Denis reagent (LOBA Chem), Distilled water, Rutin, Bromocresol green, Hydrochloric acid (Somar chem), Ammonium hydroxide (LOBA Chem), Chloroform (LOBA Chem), Methyl orange (Oxford lab), Fehling A and Fehling B reagents (LOBA Chem), Benedict's reagent (LOBA Chem), Molisch's reagent (LOBA Chem), Millon's reagent (LOBA Chem), Ferric chloride (LOBA Chem), and Sodium Hydroxide (LOBA Chem).

2.2 Collection and preparation of leaf extract

Fresh leaves of C. album. were collected in January 2023 from the agricultural field in Karandla village (classified as rural), Bhandara district. The plant material was cleaned and air-dried at ambient temperature. The dried leaves were ground into a fine powder. Ten grams of each sample were separately extracted with 100 mL of methanol and water at ambient temperature. Each extract was filtered using Whatman No. 1 filter paper and concentrated under reduced pressure to dryness below 40 °C. The extraction yields were 4.3% and 4.9% in methanol and water, respectively. The dried materials were stored in a desiccator for further analysis. As different solvents can extract different compounds from plant material, comparing the results from both solvents can provide a more comprehensive understanding of the plant's chemical composition.

2.3 Phytochemical screening

The leaf extract was subjected to phytochemical screening using standard protocols to detect the presence of alkaloids, flavonoids, phenols, tannins, saponin, and steroids (Harbone, 1973; Sofowra, 1993; Trease & Evans, 1989) [50, 129, 138].

Test for carbohydrates

Fehling's test: An equal volume of Fehling A and Fehling B reagents were mixed and 2 mL of this mixture was added to crude extract and gently boiled. A brick-red precipitate appeared at the bottom of the test tube indicating the presence of reducing sugars.

Benedict's test: Crude extract was mixed with 2 mL of Benedict's reagent and boiled. A reddish-brown precipitate was formed, indicating the presence of the carbohydrates.

Molisch's test: The crude extract was mixed with 2mL of Molisch's reagent and the mixture was shaken properly. After that, 2 mL of concentrated H_2SO_4 was poured carefully along the side of the test tube. The appearance of a violet ring at the interphase indicated the presence of carbohydrates.

Test for proteins

Millon's test: The crude extract was mixed with 2mL of Millon's reagent. A white precipitate was formed which turned red upon gentle heating, confirming the presence of proteins.

Test for alkaloids: The crude extract was mixed with 2mL of 1% HCl and heated gently. Mayer's and Wagner's reagents were then added to the mixture. The turbidity of the resulting precipitate confirmed the presence of alkaloids.

Test for flavonoids

Alkaline reagent test: The crude extract was mixed with 2mL of 2% solution of NaOH. An intense yellow color was formed which turned colorless with the addition of a few drops of diluted acid which indicated the presence of flavonoids.

Test for saponins: The crude extract was mixed with 5mL of distilled water in a test tube and was shaken vigorously. The formation of stable foam indicated the presence of saponins.

Test for phenols: Crude extract was mixed with 2mL of 2% solution of $FeCl_3$. A blue-green or black coloration indicated the presence of phenols and tannins.

Test for steroids: Crude extract with 2mL of chloroform. Then 2mL each of concentrated H_2SO_4 and acetic acid were poured into the mixture. The development of a greenish coloration indicated the presence of steroids.

2.4 Quantification

2.4.1 Phytochemical Quantification

The quantification of specific phytocompounds was performed using advanced analytical techniques such as spectrophotometric methods.

This analysis aimed to identify and determine the concentration of bioactive compounds, such as phenols, flavonoids, alkaloids, Proteins, Steroids, and Tannin. The total phenol content was estimated using the Folin-Ciocalteau reagent by the method of Sidduraju and Becker.

The tannin content was estimated by the method of Siddhuraj and Manian.

Total flavonoids were determined using the aluminum chloride colorimetric method of. (Jian, *et al*., 1999) [63].

The total alkaloid content was estimated by the Bromocresol green reaction method (Choudhary, *et al*., 2021) [27].

2.4.2 Nutritive Quantification

The extract was analyzed for nutritional components such as proteins, carbohydrates, fats, vitamins, and minerals using established analytical methods, including spectrophotometric assays and chromatographic techniques.

2.5. Biological activities

C albuml leaves offers a valuable source of potassium and vitamin C. They have a documented history of application in addressing various health concerns, including hepatic disorders, spleen enlargement, intestinal ulcers, and burns, as reported By. Several activities are specific to different parts of *Chenopodium* spp. The activities are antipruritic, antinociceptive, antimicrobial anthelmintic, induces tumor, vermifuge, antiviral, haemagglutination, antifungal, immunomodulatory, antiviral, haemagglutination, cytogenetic cytotoxic, hypotensive and spasmolytic. Polyphenols are major plant compounds with antioxidant activity, which play an important role in quenching reactive oxygen species. C album has demonstrated a remarkable safety profile as a medicinal plant, characterized by the absence of significant adverse effects. This plant holds great potential for effectively alleviating inflammation and providing relief from pain. C album has promising potential for clinical applications as a potent anti-breast cancer bioagent, offering hope in the fight against malignancy development. It has been used as a remedy for respiratory conditions such as coughs and colds. C album has been used to treat parasitic infections, particularly intestinal worms.

3. Results and Discussion

3.1 Phytochemical Screening and Quantification

Phytochemicals are natural plant compounds that improve human health when eaten as part of a diet. They can lower the risk of diseases like cancer and heart problems. Table 1 shows the results of the phytochemical screening of C. album conducted in both methanol and aqueous extracts, indicating the presence of compounds such as alkaloids, flavonoids, phenols, steroids, tannins, and saponins.

Table 1: Phytochemical Screening of C. album.

Test	Methanol extract	Aqueous extract
Carbohydrate		
Fehling test	+	+
Benedict test	+	+
Molosh test	+	+
Protein		
Millions test	+	+
Alkaloids		
Wagner's reagent	+	+
Mayers reagent	+	+
Flavanoid		
Sulphuric acid test	+	+
Tanin		
HNO_3	+	+
Saponin		
Foem test	-	+
Phenol		
Ferric Chloride (FeCl3)	+	+
Steroid		
Salkowski Test	+	+

The choice of solvent for plant extraction plays a crucial role in obtaining these phytochemicals. In this study, both methanol and water were used for extraction, with methanol proving slightly more efficient (5.9% yield) than water (4.3% yield). The presence or absence of these compounds depends on factors like the amount of plant material used, their

solubility in the chosen solvent, and the analytical method employed. For example, saponins, which were present in the aqueous extract, were not observed in the methanol extract. This is consistent with the findings from a previous study.

The phytochemicals in both the extracts of C. album were also quantified. The total phytochemical content in different extracts of C. album is presented in Table 2. Different phytochemicals in vegetables impact both their quality and nutrition, with implications for human health.

Flavonoids act as antioxidants, protecting cells from free radicals and reducing the risk of heart disease and certain cancers (Perez-Jimenez *et al*., 2010) [97]. Phenolic compounds also serve as antioxidants, mitigating oxidative stress and inflammation. Tannins, on the other hand, can have both positive and negative health effects, potentially reducing heart disease and cancer risk (Scalbert *et al*., 2002) [115]. Saponins contribute to lowering cholesterol levels, may have anti-cancer properties and aid immune system function.

Table 2: Total phytochemical quantification of C. album.

Phytochemical	Methanol extract	Aqueous extract
Alkaloid	0.43mg/g	0.41 mg/g
Flavonoid	111.00 mg/g	46.00 mg/g
Phenol	39.09 mg/g	12.58 mg/g
Steroid	23.27 mg/g	9.25 mg/g
Tannin	64.07 mg/g	12.35 mg/g

Alkaloids, organic compounds in plants, have diverse health benefits such as anti-cancer, anti-inflammatory, anti-malarial, etc.. The methanol extract of C. album contains 0.43 mg/g of alkaloids, while the aqueous extract contains 0.41 mg/g. Because alkaloids have a higher solubility in methanol than water (Dieu-Hien *et al*., 2019) [34]. It is well-known that even small amounts of alkaloids in vegetables can significantly affect animals and may be lethal at doses of 2 to 5 mg per kilogram of body weight (Zeiger, 1998) [150]. While C. album contains trace amounts of alkaloids, such as betalains (Escribano *et al*., 1997) [38], they are generally safe and even offer potential health benefits due to their antioxidant and anti-inflammatory properties. In contrast, some leafy vegetables, like spinach and lettuce, may contain low levels of pyrrolizidine and nicotine alkaloids, which can accumulate in the body and pose health risks when consumed in significant quantities (Edgar *et al*., 2011); Teschke & Eickhoff, 2015) [36, 135]. Therefore, C. album. is a healthier and safer choice for consumption due to its minimal alkaloid content.

Phenolic compounds, found in various plants, are vital in plant biology. In vegetables, they act as powerful antioxidants, reducing the risk of chronic diseases. Flavonoids and phenols, subtypes of phenolic compounds in vegetables, are recognized for their antioxidant properties and potential against cancer (Mahomoodally *et al*., 2005; Okwu, 2004; Del-Rio, *et al*., 1997; Salah, *et al*., 1995) [78-79, 90, 31, 110]. *C album* contains 111.00 mg/g of flavonoids and 39.09 mg/g of phenols in the methanol extract, while 46.00 mg/g of flavonoids and 12.58 mg/g of phenols in the aqueous extract. Methanol's moderate polarity and stability make it effective for selectively dissolving and preserving flavonoids and phenol during extraction. Higher phenol and flavonoid content indicate better antioxidant potential (Slinkard & Singleton, 1977; Mu˜niz-Ramirez *et al*., 2020; Dibal *et al*., 2022) [126, 85, 33]. Broccoli and spinach are among the top phenolic sources because they contain 0.08 and 0.8 mg/g of sample, respectively. Therefore, C. album is a notable source of phenolic compounds with higher content compared with spinach and broccoli, making it a valuable supplier of these beneficial compounds. 64.07 mg/g in methanol and 12.35 mg/g in aqueous extract. Tannins dissolve more readily in methanol compared to water because it helps break tannin-protein bonds, leading to the effective dissolution of tannins. A diet with reduced tannin intake is commonly advised for improved health, and C. album is a low-tannin option. Proanthocyanidins, a type of tannin found in various plant foods, are linked to potential health benefits (Bagchi *et al*., 2000) [11]. C album contains varying amounts of proanthocyanidins, which are considered safe when consumed through food sources (Rajendra *et al*., 2018; Espin *et al*., 2007) [105, 39].

Plant steroids, a unique group of compounds, are found throughout the plant kingdom. Some of these steroids are used in treating inflammatory disorders. Natural steroids, known as phytosterols, are similar in structure to cholesterol and are present in vegetables like tomatoes, cabbage, and spinach, but only in small amounts, so they are a dietary source of steroids. The Institute of Medicine (IOM) United States suggests an Adequate Intake of phytosterol 2 grams per day. This is considered a reasonable intake level to support heart health. C. album contains 23.27 mg of steroids in the methanol extract and 9.25 mg in the aqueous extract. However, these levels are generally too low to have a significant impact on the human body (Jia *et al*., 2013) [62]. *C album* contains various sterols, including beta-sitosterol and campesterol, similar to spinach (Carlos *et al*., 2017) [22-23]. *C album* contains sterols like spinach, such as beta-sitosterol and campesterol. To maintain a balanced diet (Jia *et al*., 2013) [62]. Thus, the presence of these phytochemicals highlights the potential medicinal value of *C album*.

3.2 Nutritional Quantification

Nutritional quantification provides insights into the composition of the extract, highlighting its protein, carbohydrate, fat, vitamin, and mineral contents. The nutritional composition of *C album* leaves is given in Table 3.

Table 3: Nutritional Quantification C Album L.

Test	UMO	Result
Calorific value	Kcal/100g	320
Protein	g/100g	21
Carbohydrate	g/100g	56.54
Fibre	g/100g	23.46
Fat	g/100g	6.31
Vitamin A	IU/100g	2,000
Vitamin C	mg/100g	230
Calcium	mg/100g	1018
Iron	mg/100g	37.8
Phosphorus	mg/100g	11.29

The calorific value of C. album is 320 kcal/100 g [Add a line]. The World Health Organization (WHO) suggests an average daily caloric intake of about 2,000 to 2,500 kcal for adult women and 2,500 to 3,000 kcal for adult men to maintain a healthy weight and lifestyle. Broccoli contains 55 kcal/100 g, Carrots 42 kcal/100 g, and Cauliflower 30 kcal per 100 g, (USDA). Vegetables are generally lower in calories compared to other food groups, but some high-calorie vegetables can provide essential nutrients and health benefits. One example is potatoes containing 87 kcal/100 g (USDA Food Database). C. album with 320 kcal/100 g, provides more calories compared to broccoli, carrots, cauliflower, and even potatoes, making it a higher-calorie vegetable option.

Carbohydrates, a vital macronutrient, serve as a primary source of energy, yielding calories in the form of sugar when digested, ultimately supplying the body with glucose, a crucial energy source. Each gram of carbohydrates contributes 4 calories to this energy pool. In maintaining a balanced diet, it is recommended to allocate 45% to 65% of daily caloric intake to carbohydrates, which typically translates to around 200 to 300 g per day, with each gram delivering 17 kJ of energy. It is important to note that the C. album contains a significant amount of carbohydrates (56.54 g). Green leafy vegetables have always been known for their high dietary fiber content. Studies have highlighted the nutritional value of Indian green leafy vegetables, including cabbage, spinach, fenugreek, coriander, and basella, which are rich sources of soluble dietary fiber. Incorporating a diet rich in vegetable fiber can contribute to various health benefits, including maintaining healthy body weight, reducing the risk of cardiovascular diseases, and potentially lowering the risk of colon cancer. The dietary fiber content in the C. album is 23.46 g. Spinach and cabbage contain only 2.2 g and 2.5 g of dietary fiber content, respectively Therefore, C. album is a good source of fiber compared to spinach and cabbage.

Fat is a vital component of the human et, serving as an energy source, regulating hormones and genes, and supporting brain health. But not all fats are equally important, unsaturated considered healthy fats, They found in foods like nuts and avocados can improve cholesterol levels and reduce the risk of heart disease. spinach has only 1 gram of fat per 100 grams whereas C. album contains 6.31 grams of fat per 100 grams. C. album is primarily composed of unsaturated fat and is a good source of it,

Vitamin A is crucial for maintaining healthy vision, a strong immune system, and proper functioning of the heart, lungs, and kidneys. It's also essential for normal growth and development, especially in children, and during pregnancy and breastfeeding. The leaves of C. album are an excellent source of vitamin A, containing 11,000 µg, which exceeds the recommended dietary allowance of 900 µg/100g. In comparison, spinach has 943 µg/100g, and broccoli has 156 µg/100g. Therefore C. album is a better vitamin A source than spinach and broccoli, making it a good choice for daily needs.

Vitamin C supports the immune system, acts as a powerful antioxidant that protects cells from damage and helps make collagen for healthy skin and tissues. It was observed that daily human dietary requirements include 60 mg of vitamin C. C. album contains 230 mg of vitamin C per 100 grams. In contrast, previous research, as cited in reported that Broccoli contains up to 82 mg of vitamin C per 100 grams, while Spinach contains 47 mg of vitamin C per 100 g, according to data from the. This suggests that C. album has substantially more vitamin C content than Broccoli and Spinach. fulfills the daily requirement of 60 mg, making it a more effective option for meeting vitamin C needs (Singh, Upadhyay, Prasad, Bahadur, & Rai, 2007) [121].

Calcium plays a crucial role in maintaining a strong skeleton and is essential for various bodily functions, including nerve function, muscle contraction, blood clotting, and metabolism, whereas iron is necessary for combating conditions like anemia, tuberculosis, and growth disorders. According to the daily dietary requirements for humans include 750 mg of calcium and 10 mg of iron. In this context, C. album green leaves are found to be highly nutritious and rich in calcium. Specifically, C. album contains 1018 mg of calcium and 37.8 mg of iron. Comparatively, broccoli contains 62 mg of calcium per 100 g and 0.7 mg of iron per 100 g, while spinach contains 136 mg of calcium per 100 grams and 2.7 mg of iron per 100 grams. Therefore, C. album boasts a higher calcium and iron content than spinach and broccoli. These variations in nutritional content can be attributed to the genetic diversity among plant species. As a result, C. album stands out as a nutritious option that can effectively help meet daily calcium and iron requirements.

Phosphorus is essential for various biological processes, such as bone formation and energy metabolism. It is naturally found in a wide range of foods, including dairy products like milk, yogurt, and cheese. However, excessive phosphorus intake, beyond the recommended amount of 155 mg of phosphorus per day, can lead to bone loss. In this study, C. album L contains 11.29 mg/100g of phosphorus. This value is close to the phosphorus content in tomatoes, i.e., 11 mg/100g of phosphorus C and Tomatoes have similar phosphorus content and should be consumed in moderation, as part of a balanced diet that help meets nutritional needs.

Proteins play a crucial role in plant growth and development and are made up of essential amino acids that can enhance their properties. Ten amino acids are strictly essential, lysine, isoleucine, leucine, phenylalanine, tyrosine, threonine, tryptophan, valine, histidine, and methionine. These essential amino acids are present in Green leafy vegetables like spinach and broccoli. Spinach has about 2.86 g of protein per 100g and broccoli contains 2.82 g/100g. C. album. contains 21 grams/ 100g of protein. C. album contains all ten strictly essential amino acids making valuable high-protein source. C. album is valuable for its high protein content, boasting a well-balanced profile of amino acids.

Research indicates that including vegetables abundant in secondary metabolites like flavonoids, polyphenols, vitamins, carotenoids, and minerals, in a regular diet can lower the risk of chronic diseases like cancer and heart conditions.

Table 4: Ancient medicinal uses of *C. album.*

Treated diseases	Consumer	References
Anti-Inflammatory	In traditional Chinese medicine, it was used to alleviate inflammation.	
Digestive Aid	Relieve digestive discomforts	
Respiratory Ailments	Remedy for respiratory conditions such as coughs and colds.	
Fever Reduction	Lower fever.	
Rheumatism and Arthritis	Alleviate symptoms of rheumatism and arthritis	
Menstrual Disorders	Menstrual irregularities	
Anti-Diarrheal	Remedy for diarrhoea	

3.3 Ethno pharmacology

The chemical composition of *C. album* was conducted using two different solvents-methanol and water. Plant extracts were found to contain various phytochemicals, including phenols, tannins, flavonoids, saponins, steroids, and alkaloids. Phenolic compounds, a widespread group of plant metabolites, were also detected in the extracts.

4. Conclusion

The findings of this research reveal that C. album leaf extracts contain a diverse array of phytochemicals, including alkaloids, flavonoids, phenols, and tannins. This phytochemical composition suggests the potential medicinal value of the plant. Additionally, the nutritional analysis revealed that C. album is a rich source of essential nutrients. It contains significant amounts of proteins, carbohydrates, fats, vitamins (such as vitamin A and vitamin C), and minerals (including calcium, iron, and phosphorus). These nutritional components make it a valuable addition to the diet. Furthermore, the variation in phytochemical and nutrient content in different solvents, such as methanol and water, highlights the importance of extraction methods in harnessing the plant's bioactive compounds and nutritional value. this study underscores the potential health benefits associated with C. album and provides a foundation for further research into its pharmacological and nutritional properties. The findings support the traditional use of this plant and its potential for various applications in the fields of medicine and nutrition.

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6. Conflict of Interest

The authors declare that there is no conflict of interest.

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