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Nutritional, Elemental and Phytochemical Analysis of *Malva neglecta* and *Nastrurtium officinale*

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ABSTRACT

This study documented the ethnobotanical uses and evaluated the phytochemical and nutritional composition of *Malva neglecta* wallr and *Nasturtium officinale* W.T Aiton from the study area. Data were collected from 50 informants through interviews and discussions. Both species are widely used as food and medicine; *Malva neglecta* wallr is consumed as cooked vegetables and used for cough, bronchitis, urinary disorders, and skin infections, while *Nasturtium officinale* W.T Aiton is eaten fresh in salads and used to treat liver, kidney ailments, respiratory infections, and vitamin C deficiency. Phytochemical screening revealed the presence of alkaloids, flavonoids, and phenols in both plants, while glycosides, saponins, tannins, and steroids were detected only in *Malva neglecta* wallr. Proximate analysis showed that *Malva neglecta* wallr contained 69.03% carbohydrates, 9.57% ash, 8.85% moisture, 5.50% fiber, 4.11% fat, and 2.94% protein, whereas *Nasturtium officinale* W.T Aiton contained 70.78% carbohydrates, 10.15% ash, 8.44% moisture, 4.35% fiber, 4.02% fat, and 2.26% protein. These findings highlight the nutritional and medicinal importance of these wild edible plants, supporting their role as functional foods and potential sources of bioactive compounds.

Keywords— Malva neglecta, Nastrurtium officinale, Phytochemical analysis, Alkaloids, Flavonoids

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Introduction

Pakistan is a developing country and the world's eleventh highest-risk country for food security (Khan et al., 2021). Approximately 40% of families in Pakistan, especially in rural areas, are considered food insecure due to the region's large population and recurrent natural and anthropogenic disasters that compromise local means of survival and food access (Sher et al., 2012; Ahmed et al., 2021). The demand for food and nutrition has increased in developing and poor countries over the last two decades. This is due to overpopulation, food scarcity, high inflation rates, and low livelihood income, less agricultural produce, loss of biodiversity, habitat degradation, and natural disasters. Apart from other food alternatives, wild edible plants (WEPs) are believed to be a cheap and inexpensive source of human food and diet (Duguma et al., 2020; Peduruhewa et al., 2021). Wild edible plants (WEPs) and vegetables are imperative and dynamic sources of essential nutrients. These plants also provide vital elements or minerals such as magnesium, potassium, calcium, iron, sulfur, zinc. Research studies on these wild edible plants (WEPs) have revealed that some fruits and vegetables have more dietary nutrients, minerals, and energy values than commercial fruits and vegetables available in the market (Kaparapu et al., 2020).

Pakistan has been to accommodate with quarter's spacious wealth of plant resources and which have important properties more than 1,000 plant species have been reported, have medicinal values and used as remedies for various diseases (Sher et al., 2010). Herbs provide us nutritional and trace elements and also provide chemical of medicinal value, every one play important role if deficiency cause of any one and may lead to abnormal developments in the body (Kiczorowska et al., 2015; Messaoudi et al., 2025). Some Essential elements detected in the aerial parts of different medicinal plants used in the better treatment of different diseases. Some physician and local people used medicinal plants in high concentration in different mode (Halberstein, 2005; Abera, 2014).

Nearly 40% of households in northwest Pakistan are considered to be food insecure as a result of the region's large population and frequent natural and manmade disasters that endanger local means of subsistence and food access (Sher et al., 2010). Using wild edible plants as food is a crucial local survival tactic during periods of famine or drought. Threats to the preservation of biodiversity may arise from the unsustainable use of some rare species or plant parts (Khan et al., 2013). To demonstrate the importance of local plant species such as in the development of new drugs, ethno botanical research is essential (Süntar, 2020).

Malva neglecta Wallr. (common mallow) and *Nasturtium officinale* W.T Aiton (watercress) are two notable wild edible and medicinal plants belonging to the families Malvaceae and Brassicaceae, respectively. Both species grow in temperate regions, are valued for their rich nutritional and phytochemical profiles, and have traditional uses in herbal medicine. Although *Malva neglecta* wallr and *Nasturtium officinale* W.T Aiton are commonly used for food and traditional medicine, very few studies have provided detailed ethnobotanical data along with phytochemical screening and nutritional analysis, especially in the study region. Most previous research is limited to traditional uses only, without scientific validation of their bioactive compounds and nutritional value. This lack of combined ethnobotanical and phytochemical information created the need for this study to document their traditional uses and scientifically evaluate their chemical and nutritional composition. The current study was conducted to record the traditional ethnobotanical uses, analyze proximate nutritional composition, and perform qualitative phytochemical screening of *Malva neglecta wallr* and *Nasturtium officinale* W.T

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Aiton. for bioactive compounds.

Material and Method

Description of the study area

The research area of the district of Malakand, Pakistan, is geographically situated at 34°35′North latitude and 71°57′E (Fig. 1). The total covered area of the district of Malakand is 952 square kilometers. Most of the area is hilly and scenic. Malakand has varied climatic conditions; summer is hot, whereas winter is slightly cooler. The soil is mostly sandy loam with rich biodiversity. People are mostly poor and depend on farming and livestock rearing for their livelihood. The main tribes that dwell here are Ranizai, Baizai, Piran, Syeds, Yousafzai, Utmankhel, and Gujjars. Most people speak Pashto, whereas the Gujjar families speak both Pashto and Gujri (Ibrahim et al., 2023).

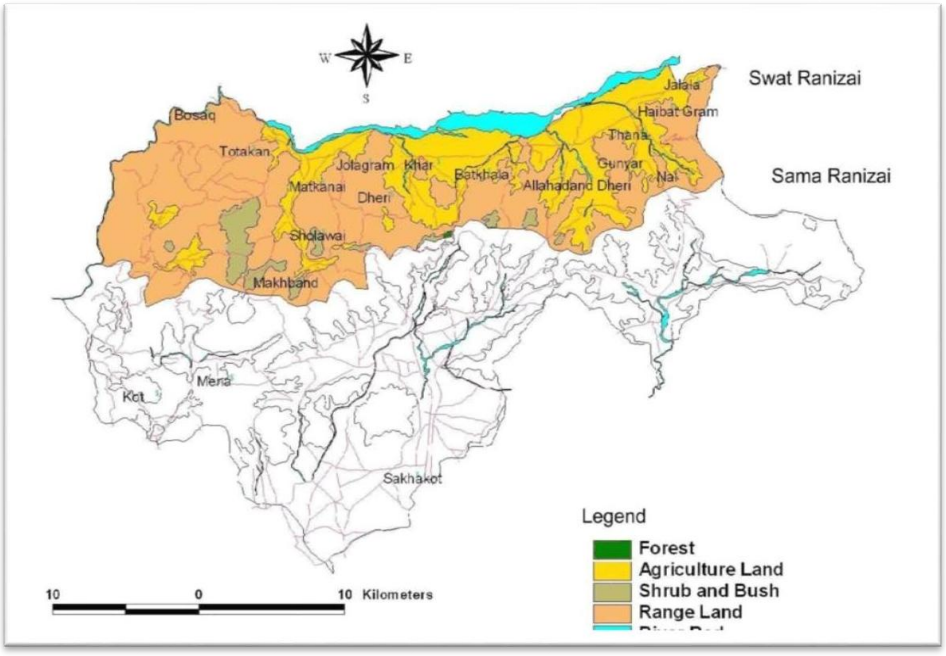

Fig. 1 Map of the study area Maina Kot Manzary Baba District Malakand.

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Field Trips and Collection of Ethnobotanical Data

Field trips were made in different seasons of 2025 to collect ethnobotanical data about wild edible plants (WEPs) from the local district of Malakand, Pakistan. Verbal permission was sought from local people before formal interviews. A semi-structured questionnaire was used to collect ethnobotanical data from the local people. About 50 informants from different age groups, genders, and educational backgrounds were interviewed during this survey. Most of the informants were old age elders of the area as they had more knowledge and experience of local plants and their edible uses (Ibrahim *et al*., 2023; Misra *et al*., 2008).

Collection and Identification of Plants

WEPs were collected from different sites in the research area during field trips. The collected plants were identified with the help of the available literature and flora of Pakistan.

Plant Samples Preparation

The collected plant samples were carefully washed to remove dirt and plant debris. The plants or their used parts were then shade-dried at room temperature (Müller et al., 2006). The dried plant samples were powdered in a grinder and stored at room temperature. The powdered plant samples were then subjected to proximate nutritional and elemental analyses (Kashyap et al., 2022).

Phytochemical Screening for Bioactive Compounds

The confirmatory qualitative phytochemical screening of plant extracts was performed to identify the main classes of compounds (tannins, saponins, flavonoids, alkaloids, phenols, glycosides, steroids, and terpenoids) present in the extracts following standard protocols (Shaikh and Patil, 2020; Dubale et al., 2023).

Proximate Analysis

The selected plant samples were subjected to proximate nutritional analysis at the Agricultural Chemistry Laboratory, Agricultural University Peshawar, Pakistan, following the official methods of the Association of Official Agricultural Chemists (Chen et al., 2016).

Determination of moisture content, protein, fats and ash contents, and crude fibers

The said parameters were measured with the help of AOAC methods (Thiex et al., 2012).

Results and Discussion

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Demography of Informants

Ethnobotanical data on wild edible plants (WEPs) were collected through frequent field visits to the study area. A total of 50 local informants were interviewed using semi-structured questionnaires, individual interviews, and group discussions. Regarding gender distribution, 40 informants (80%) were male, while 10 (20%) were female. Based on educational background, 20 informants (40%) were illiterate, 10 (20%) had primary education, 7 (14%) had completed middle school, 5 (10%) had secondary education, 3 (6%) had higher secondary education, and 3 (6%) had attained higher education (Table 1). All informants were aged between 25 and 86 years. Most of the participants were elderly, as they possessed greater knowledge and experience regarding local wild edible plants and their uses. These findings are in accordance with those of Ibrahim et al., (2023).

Table 1. Demographic characteristics of informants.

Category	Sub-category	Number	Percentage (%)
Gender	Male	40	80
	Female	10	20
Education Level	Illiterate	20	40
	Primary Education	10	20
	Middle Education	7	14
	Secondary Education	5	10
	Higher Secondary	3	6
	Higher Education	3	6

Ethnobotanical uses of selected plants

This study documents the diverse ethnobotanical uses of *Malva neglecta* wallr (common mallow) and *Nasturtium officinale* W.T Aiton (watercress) in the study area (Table 2, Fig. 2). Both species are widely utilized as food, traditional medicine, and livestock fodder. *Malva neglecta* wallr is primarily consumed as a green vegetable, either cooked as *saag*, added to soups, or mixed with lentils and wheat flour. Medicinally, it is employed to treat cough, sore throat, bronchitis, constipation, urinary disorders, fever, joint pain, and skin infections, while leaf poultices are applied to wounds and inflammation. The plant also serves as a valuable fodder source, and its dried leaves are preserved for winter consumption. Similarly, *Nasturtium officinale* W.T Aiton is eaten fresh in salads and chutneys, cooked with vegetables, or used as garnish. It holds significant medicinal value as a blood purifier and a tonic for liver and kidney ailments. Additionally, it is used to manage respiratory infections, anemia, diabetes, and vitamin C deficiency, while also improving appetite and digestion. Its juice is sometimes applied externally to reduce inflammation or used as a natural hair rinse. Both species reflect the deep-rooted traditional knowledge and reliance on wild plants for nutrition, healthcare, and livelihood support. Our findings are in agreement with those of Kiczorowska et al., (2015).

Table 2. Detailed ethnobotanical uses of *Malva neglecta* wallr and *Nasturtium officinale* W.T

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Aiton

Plant Species	Part Used	Mode of Use	Reported Uses
***Malva neglecta* Wallr**	Leaves, shoots	Cooked vegetable, soup, decoction	Cooked as vegetable (*saag*), added to soups; treats cough, bronchitis, sore throat, constipation, gastritis; used as a mild diuretic, for joint pain, wounds, skin infections; anti-inflammatory; febrifuge; fodder for animals
	Seeds	Powder or decoction	Mild laxative, digestive aid, urinary problems
	Whole plant	Stored dried	Used as winter food supplement
Nasturtium officinale W.T Aiton	Leaves, stems	Salad, chutney, cooked with vegetables	Blood purifier; liver tonic; kidney health; respiratory infections; improves digestion; anti-anemic; anti-diabetic; treats vitamin C deficiency; anti-inflammatory poultice; appetite stimulant
	Whole plant	Fresh juice, decoction	Used as general tonic, detoxifier, anti-scurvy remedy; hair rinse; fodder for livestock

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Fig. 2 Selected medicinal plants (a) *Malva neglecta* Wallr (b) *Nasturtium officinale* W.T. Aiton

Bioactive Compounds in Selected Plant Species

The phytochemical screening of *Malva neglecta* Wallr and *Nasturtium officinale* W.T. Aiton revealed the presence of several bioactive compounds. Both plants tested positive for alkaloids, flavonoids, and phenols. However, glycosides, saponins, tannins, and steroids were detected only in *Malva neglecta* wallr and were absent in *Nasturtium officinale* W.T Aiton (Table 3). These results justify the findings of Messaoudi et al., (2025).

Table 3 Bioactive Compounds in *Malva neglecta* wallr and *Nasturtium officinale* W.T. Aiton

Phytochemicals	*Malva neglecta* wallr	*Nasturtium officinale* W.T Aiton
Alkaloids	+	+
Flavonoids	+	+
Glycosides	+	-

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Phenols	+	+
Saponins	+	-
Tannins	+	-
Steroids	+	-

Key: (+) shows the presence while (–) shows the absence.

Proximate analysis of *Nasturtium officinale* W.T Aiton

The proximate analysis of *Nasturtium officinale* W.T Aiton revealed that carbohydrates were the predominant component, accounting for 69.03%, indicating its role as a primary energy source. The ash content was 9.57%, suggesting the presence of essential minerals, while moisture content was 8.85%, which helps in maintaining freshness and quality. Crude fiber was recorded at 5.5 %, contributing to digestive health, whereas crude fat and crude protein were found to be 4.11% and 2.94%, respectively (Table 4), reflecting moderate lipid content and a low protein level. These findings emphasize the nutritional significance of *Nasturtium officinale* W.T Aiton as a carbohydrate-rich leafy plant with appreciable mineral and fiber content. These results are in agreement with those of Messaoudi et al., (2025).

Table 4 Proximate Composition of *Nasturtium officinale* W.T Aiton

ASH	9.57%
MOISTURE	8.85%
CRUDE FIBER	5.5%
CRUDE FAT	4.11%
CRUDE PROTIEN	2.94%
CARBOHYDRATE	69.03%

Proximate analysis of *Malva neglecta* wallr

The proximate analysis of *Malva neglecta* wallr revealed a high carbohydrate content (70.78%), making it a significant source of energy. Moisture content was recorded at 8.44 %, while ash content constituted 10.15 %, indicating the presence of essential minerals. Crude fiber was measured at 4.02 %, which suggests its potential role in promoting digestive health. The plant contained 4.02% crude fat and 2.26% crude protein (Table 5), reflecting moderate levels of lipids and proteins. These findings highlight the nutritional value of *Malva neglecta* wallr as a carbohydrate-rich leafy vegetable with appreciable mineral and fiber content. These results are in agreement with those of Sher et al., (2012).

Table 3. 5. Proximate Composition of *Malva neglecta* wallr

Component	**Percentage**
ASH	10.15%

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MOISTURE	8.44%
CRUDE FIBER	4.35%
CRUDE FAT	4.02%
CRUDE PROTIEN	2.26%
CARBOHYDRATE	70.78%

Conclusion

The findings highlight the dual role of *Malva neglecta* Wallr and *Nasturtium officinale* W.T Aiton as sources of essential nutrients and bioactive compounds. Their rich nutritional composition and therapeutic potential make them valuable candidates for inclusion in functional foods, nutraceutical products, and herbal medicines. Promoting the sustainable utilization and conservation of these species can play a vital role in combating malnutrition, enhancing food diversity, and supporting natural health remedies. Future research should focus on detailed pharmacological evaluations and clinical studies to fully explore their medicinal applications and safety profiles.

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