

Ethnobotanical and Phytochemical Assessment of Selected Traditional Food Grains of Chamba District, Himachal Pradesh

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Pseudocereals such as Amaranthus, Buckwheat, and Quinoa are nutritionally valuable crops increasingly cultivated in India, with major production seen in states like Uttar Pradesh, Andhra Pradesh, Gujarat, Punjab, and Haryana (Chaudhary & Singh, 2020; Paschapur *et al.*, 2021). Himachal Pradesh, a hilly northern state covering 1.7% of India's geographical area, has also shown a notable rise in grain crop production due to favourable climate, improved farming practices, irrigation facilities, and government support (Thakur *et al.*, 2014; Chaudhary & Singh, 2020). Agriculture remains the primary livelihood for over 85% of the state's population. Among the twelve districts of Himachal Pradesh, Chamba is known for cultivating a variety of traditional food grains, including pseudocereals and millets such as Amaranth, Buckwheat, Quinoa, Finger millet, and Foxtail millet, alongside other crops like soybean, lentils, and barley (Satyarthi, 2018; Chrungoo & Chettry, 2021). These cereals are high in phytochemical and nutritional content and have ethnobotanical and dietary importance (Samtiya *et al.*, 2021; Rastogi & Shukla, 2013; Vilcacundo & Hernández-Ledesma, 2017). There is scarce scientific literature discussing their phytochemical composition, especially in relation to the Chamba region.

This research targets such ancient crops of Chamba and their nutritional and phytochemical content. Amaranth and Quinoa, known to be gluten-free, rich

in protein, and medicinally valued, are tolerant crops that grow well under varying conditions (Park *et al.*, 2020; Graf *et al.*, 2015). Buckwheat too is known to be rich in antioxidants and flavonoids (Rutin) (Chrungoo & Chettry, 2021). Millets-like Finger and Foxtail millet are rich in nutrients and commonly used throughout India in different food preparations (Kumari *et al.*, 2024; Sharma & Niranjana, 2018; Ramashia *et al.*, 2019). Phytochemicals—bioactive compounds present in all parts of the plant—are vital in plant defense and provide a host of health benefits to humans, such as antioxidant, anti-cancer, and cardiovascular protective activity (Samtiya *et al.*, 2021; Tiwari *et al.*, 2013). These comprise classes of phytochemicals such as polyphenols, carotenoids, alkaloids, and terpenes. Grains and legumes, as staple foods, are significant sources of these phytochemicals and play a major role in human nutrition and disease protection. The research hopes to record and examine the phytochemical composition of Chamba's indigenous food grains, hence underlining their nutritional significance and potential health implications.

The ethnobotanical survey was carried out in Chamba and Dharwala villages of the Chamba district of Himachal Pradesh in the western Himalayas. These areas are notable for extensive cultivation of customary food grain landraces, cultivated every year for consumption as well as commercial purposes.



Dharwala is situated about 25 km from Chamba town. During January–February 2024, a 15–20 day field visit was conducted to collect traditional food crop samples—*Amaranthus*, *Fagopyrum*, *Chenopodium*, *Eleusine coracana*, and *Setaria italica*—from locals in Chamba and Dharwala. A total of 12 samples were collected and preserved in plastic bags, of which 5 were selected for phytochemical analysis. The local farmers, primarily engaged in the cultivation of these crops, expressed strong interest in maintaining traditional grains due to their nutritional and economic value. The crops are cultivated during the Kharif or Rabi seasons, depending on the variety. A structured questionnaire was used for the survey, gathering data through direct interaction with local farmers. The questions focused on local names, cultivation practices, uses, and socio-cultural relevance of traditional food grains.

In January 2024, surveys were conducted in 11 locations of Chamba tehsil using questionnaires. Participants included individuals across different age groups and occupations. The interviews, conducted in the ‘Chambiyali’ dialect, were preceded by obtaining Prior Informed Consent. Data collected included local knowledge about names, seasons, practices, harvesting, and ethnobotanical uses of traditional grains.

Seeds of *Amaranthus*, *Fagopyrum* (buckwheat), *Chenopodium*, *Eleusine coracana* (finger millet), and *Setaria italica* (foxtail millet) were processed for phytochemical screening using the cold maceration method. Samples were shade-dried, powdered, and soaked in methanol (1:10) for 72 hours with regular shaking. The filtered extracts were then used for further testing. Qualitative phytochemical tests were conducted on methanolic extracts following standard protocols with minor modifications. The tests included Mayer’s test (alkaloids), Resorcinol and Benedict’s tests (carbohydrates and reducing sugars), Baljet’s test (glycosides), Millon’s test (proteins), Ferric chloride test (flavonoids), lead acetate and NaOH tests (tannins), foam test (saponins), Hesse’s and Salkowski’s tests (phytosterols and terpenoids), and NaOH test (coumarins). Each test identified specific compounds based on characteristic color changes or precipitate formation.

This study aimed to document the ethnobotanical relevance and conduct phytochemical screening of five traditional food grain crops cultivated in Chamba:

Table 1. Ethnobotanical relevance and phytochemical presence in selected food grains of Chamba

Scientific Name	Local Name	Key Ethnobotanical Uses	Alk	Flav	Carb	Prot	RS	Gly	Tann	Sap	Phyt	Terp	Coum
<i>Amaranthus</i> spp.	Seul	Consumed as popped grains, laddu, kheer, used in rituals and healing	+	-	+	+	+	+	+	+	+	+	+
<i>Fagopyrum</i> spp.	Fullan	Used in fasting foods, halwa, animal feed	+	+	+	+	+	+	+	-	+	-	+
<i>Chenopodium</i> spp.	Bajarbhang	Leaves and grains consumed as spinach and rice alternative	+	-	+	+	-	-	+	+	+	-	+
<i>Eleusine coracana</i>	Kodra	Used in pinadadi, lugadu, soup for lactating mothers	-	+	+	+	+	+	+	+	+	-	+
<i>Setaria italica</i>	Kauni	Cooked as rice substitute, used as animal fodder	-	+	+	+	+	+	-	+	+	+	+

(+): Present; -: Absent; Alk: Alkaloids; Flav: Flavonoids; Carb: Carbohydrates; Prot: Proteins; RS: Reducing sugars; Gly: Glycosides; Tann: Tannins; Sap: Saponins; Phyt: Phytosterols; Terp: Terpenoids; Coum: Coumarins)



Amaranthus spp., *Fagopyrum spp.*, *Chenopodium spp.*, *Eleusine coracana*, and *Setaria italica*.

Phytochemical analysis revealed diverse bioactive compounds among the selected crops (Table 1). *Amaranthus spp.* exhibited the widest range of phytochemicals, lacking only flavonoids. *Fagopyrum spp.* was rich in antioxidants and flavonoids but lacked terpenoids and saponins. *Chenopodium spp.* lacked several key components, including flavonoids and glycosides. *Eleusine coracana* was rich in most constituents except alkaloids and terpenoids. *Setaria italica* lacked alkaloids and tannins.

According to the results of phytochemical screening using Methanol as a solvent, *Amaranthus spp.* showed the presence of all the phytochemicals except Flavonoids, while in earlier findings (Ahmed *et al.*, 2013) flavonoids are present in *Amaranthus viridis*. Terpenoids and Saponins were absent in *Fagopyrum spp.*, as in the study (Bhaduri *et al.*, 2016) show the absence of these in *Fagopyrum spp.* Flavonoids, reducing sugars, glycosides, and terpenoids were absent in the *Chenopodium spp.* while Flavonoids, reducing sugars, and terpenoids show presence in the study (Kadri Mounira *et al.*, 2021). *Eleusine coracana* extract was found to possess all the constituents except alkaloids and terpenoids, and all other bioactive components such as flavonoids, glycosides, tannins, and saponins also show presence in the study (Venu *et al.*, 2022). Alkaloids and tannins are not found in *Setaria italica*, whereas alkaloids exist in the study (Sangma *et al.*, 2021) but saponins, tannins, and flavonoids do not exist in it.

Overall, the traditional food grain crops of Chamba district play a vital role in ensuring food security, sustaining local dietary patterns, and supporting indigenous medicinal practices. These grains, enriched with phytochemicals such as alkaloids, flavonoids, and saponins, contribute significantly to the nutritional and health needs of the local population. Promoting their cultivation is crucial not only for preserving the region's cultural heritage but also for advancing sustainable and resilient food systems.

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Author contributions

The final version of the text was prepared with equal contributions from all writers.

Conflict of Interest

The authors confirm that there are no conflicts of interest related to this manuscript.

Ethical Approval

The article doesn't contain any study involving ethical approval.

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No

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