

Documentation and Assessment of Nutraceutical Potential of Climate Resilient Food Grain Crops from Himachal Pradesh

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ABSTRACT

Himachal Pradesh has diverse agro-climatic conditions ranging from subtropical valleys to high-altitude temperate and cold desert regions. The state harbours a rich diversity of traditional food grain crops that are well adapted to climatic variability, marginal agricultural conditions, and low-input farming systems. These indigenous crops represent an important component of local food and nutritional security and possess considerable potential as sources of nutraceuticals and health-promoting bioactive compounds. However, their diversity, traditional uses, nutritional properties, and nutraceutical potential remain inadequately documented and underutilized. The proposed study aims to systematically document, characterize, and assess the nutraceutical potential of climate-resilient food grain crops traditionally cultivated and consumed in different agro-climatic zones of Himachal Pradesh. The study will focus on locally important and climate-resilient cereal and pseudo-cereal crops, including finger millet (*Eleusine coracana*) (Mandua/Koda), barnyard millet (*Echinochloa frumentacea*) (Sanwa/Jhangora), foxtail millet (*Setaria italica*) (Kangni), buckwheat (*Fagopyrum esculentum*) (Kuttu/Phaphra), and amaranth (*Amaranthus hypochondriacus*). Crop diversity, distribution, cultivation practices, local names, traditional food preparations, harvesting practices, and ethnobotanical knowledge associated with these crops will be recorded through field surveys, farmer interviews, and interaction with local communities. The nutraceutical potential of these crops is reflected in their diverse nutritional and functional constituents, including carbohydrates, proteins, dietary fibre, lipids, minerals, vitamins, phenolics, flavonoids, tannins, and other phytochemicals. Available studies report several health promoting properties associated with these grains, including antioxidant, anti-inflammatory, antimicrobial, antidiabetic, antihypertensive, and enzyme-inhibitory activities. Bioactive constituents such as phenolic acids, flavonoids, tannins, and other secondary metabolites further contribute to their functional food and nutraceutical significance. Traditional processing practices, including germination, fermentation, roasting, and cooking, are also known to influence the nutritional quality, bioavailability, and functional properties of these grains. Documentation of such nutritional attributes, bioactive compounds, biological activities, and traditional processing practices provides an integrated basis for assessing the nutraceutical potential of climate-resilient food grain crops of Himachal Pradesh. Identification of nutritionally superior crops and bioactive-rich landraces could support their wider utilization as functional foods and nutraceutical ingredients. The study is expected to contribute towards the conservation of traditional crop diversity, strengthening of climate-resilient agriculture, improvement of dietary diversity and nutritional security, and development of value-added food products based on indigenous Himalayan resources. By integrating traditional knowledge with modern nutritional and phytochemical assessment, the research will establish a scientific basis for promoting neglected and underutilized food grains as sustainable, health-promoting crops under changing climatic conditions.

Keywords: Climate resilient, Food grain, Functional food, Local crops, Nutraceutical

Observation and results

Scientific name	Family	Common name	Distribution in H.P.	Folk and traditional uses	Nutraceutical Potential	References
<i>Amaranthus hypochondriacus</i>	Amaranthaceae	Saryara, Sarakh, Bathu	Shimla, Kullu, Mandi, Kangra, Chamba, Kinnaur, Lahaul-Spiti.	Leaves: Young/ten der leaves are boiled, drained and fried as chaulai ka saag.	Phenolics, flavonoids, antioxidants and bioactive peptides; nutritionally valuable gluten-free grain.	Amaranth and Buckwheat grains, 2024; Chandran et al., 2021
<i>Echinochola frumentacea</i>	Poaceae	Sawan/Sawa, Madira	Sirmaur, Shimla and Kinnaur districts, generally upto about 2300m elevation	Traditionally used as staple grain, commonly used as fasting food.	Antioxidant constituent and dietary fibre; potentially useful in low-glycaemic and functional foods.	Bharti et al., 2018; Sharma et al., 2021
<i>Eleusine coracana</i>	Poaceae	Koda, Kodra, Ragi, Mandua	Shimla, Kullu, Sirmaur, Solan, Chamba, Kangra, Kinnaur and Lahaul-Spiti.	Leaf juice for childbirth, diuretic, vermifuge, remedy for leprosy, liver disease, measles, pneumonia.	Phenolic compound, antioxidants and dietary; potential role in antioxidant and metabolic health-promoting foods	Bharti et al., 2018; Sharma et al., 2021
<i>Fagopyrum esculentum</i>	Poaceae	Phaphra, Fafra, Ogla, Kuttu	Shimla, Kinnaur, Kullu, Kangra (Bhangal area), Lahaul-Spiti and Chamba.	Traditionally it is valued as a health-promoting food and is associated with management of blood sugar and cholesterol.	Strong potential as an antioxidant-rich, gluten-free functional food.	Ejigu et al., 2025; Sharma et al., 2021; Kumari et al., 2025

<i>Setaria italica</i>	Poaceae	Kangni/ Kauni	Sirmaur, Bilaspur, Solan, Shimla, Mandi, Kangra, Hamirpur, Una, Kullu and Chamba.	Traditiona lly used as a staple grain and is prepared as porridge; used for strengthen ing the body and maintainin g general health.	Phenolics, flavonoids and antioxidant compound; useful for functional foods.	Bharti et al., 2018; Sharma et al., 2021.
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Conclusion

The present study demonstrates the considerable nutraceutical potential of climate-resilient food grain crops cultivated in Himachal Pradesh. Traditional crops such as buckwheat, millets, amaranth, barley and indigenous maize are well adapted to the diverse Himalayan agro-climatic conditions and contribute significantly to food and nutritional security. Their grains are rich in proteins, dietary fibre, minerals, vitamins and bioactive compounds, including phenolics, flavonoids and other antioxidants. The documentation of these crops highlights their value as locally adapted, low-input and climate-resilient agricultural resources. Their nutritional and phytochemical properties make them promising candidates for functional foods, nutraceutical products and dietary diversification. However, further efforts are needed for their systematic nutritional evaluation, value addition, improved processing and conservation of traditional landraces. Overall, the promotion and sustainable utilization of these indigenous crops can contribute to climate-resilient agriculture, conservation of Himalayan agrobiodiversity, improved nutritional well-being and enhanced livelihoods of local farming communities. Further research on their phytochemical profiles, antioxidant activity, bioavailability and health-promoting effects will help establish their potential for wider nutraceutical and commercial applications.

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