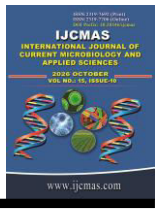
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Horse Gram: Nutritional, Medicinal, and Agronomic Perspectives of a Climate-Resilient Pulse of Himalayan Regions

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A B S T R A C T

Horse Gram, is a fascinating legume with deep cultural and medicinal significance, especially in the Himalayan regions like Uttarakhand. It's cherished not only as a staple food but also as a traditional remedy. It requires minimal inputs, thrives in poor soils, and is valued for both food and fodder. It is grown in hilly regions of Himalayas and other dry areas of India It is hardy, drought-resistant pulse crop. It has short duration (60–90 days). Horse gram is rich in protein, iron, calcium, and fiber and supports hemoglobin, bone health, and digestion. Its mineral richness — calcium and phosphorus — supports bone health and metabolism, while its st rong diuretic properties make it renowned in traditional medicine for dissolving kidney stones. Horse Gram also aids weight management by reducing hunger hormones and boosting metabolism, and offers cardiovascular and liver support through its antioxidants and cholesterol-regulating compounds. Consumed in dishes, it embodies Himalayan wisdom where food is both nourishment and medicine. Today, it is recognized globally as a climate-resilient food due to its exceptional nutritional value and its ability to thrive in harsh, drought-prone environments.

Introduction

Horse gram (*Macrotyloma uniflorum*) is a highly drought-resistant, nitrogen-fixing pulse native to tropical southern Asia. It thrives in semi-arid environments and marginal soils. It plays a crucial ecological role in soil esnrichment, erosion control, and sustainable dryland farming systems. A robust taproot accesses deep moisture and nutrients, enabling survival on under 30 cm of rainfall. It grows well in rocky, gravelly, and acidic soils (pH 5.0–7.5) where other crops fail. It is highly tolerant to heat waves, with optimal growth temperatures ranging between 20–30°C. *Macrotyloma uniflorum* (Horse Gram) is a climate-resilient pulse that supports sustainable farming by thriving in drought-prone soils, enriching fertility through nitrogen fixation, and offering a low-input, high-protein food source for both humans and livestock. (Padmanabhan 2023) Its adaptability makes it vital for smallholder farmers in semi-arid regions like Uttarakhand. *Macrotyloma uniflorum* (Horse Gram) plays a crucial role in food security, especially in regions vulnerable to climate change and resource scarcity. (Kashid 2021) Its resilience, nutritional richness, and dual-purpose use make it a strategic crop for sustainable diets and farming systems. (Barman 2018). Horse Gram (Horse Gram) is a hardy

pulse crop widely cultivated in Uttarakhand's hilly regions, thriving in poor soils and low rainfall conditions. It enriches soil fertility through nitrogen fixation and provides high-protein, iron, and calcium-rich food, making it both nutritionally and agriculturally valuable. (Banerjee 2022, Agnihotri 2021)

Horse gram is considered a "poor man's pulse" but nutritionally it's a powerhouse: It is high in protein and iron as well as rich in polyphenols and antioxidants It is traditionally valued for its warming properties in cold climates. Horse Gram (*Macrotyloma uniflorum*, also known as Horse Gram) is widely used in Uttarakhand and Himalayan regions for both culinary and medicinal purposes. Its products range from traditional dishes to therapeutic preparations. Horse Gram (Horse Gram) plays a modest but vital role in Uttarakhand's rural economy, especially in hilly regions like Tehri. (Sharma 2019) It is grown on about 11,000 hectares in the state, producing nearly 11,000 tonnes annually, and serves both as a staple food and a source of income for small farmers. Its rising demand and medicinal value are creating new market opportunities. (Sreerama 2012, Kawsar 2008, Longwah 2017, Narvekar 2023)

Soil Ecology: It forms symbiotic relationships with *Rhizobium* bacteria to fix atmospheric nitrogen into the soil. Its significant deciduous leaf drop increases soil organic carbon and improves soil structure. Its twining, dense growth habit provides ground cover that reduces wind and water erosion. *Macrotyloma uniflorum* (Horse Gram) plays a vital role in soil fertility improvement, making it an ecologically sustainable crop for semi-arid and marginal lands. (Sreerama 2012) Its ability to fix nitrogen, enrich organic matter, and support crop rotations enhances long-term agricultural productivity. *Macrotyloma uniflorum* (Horse Gram) contributes to carbon sequestration by enriching soils with organic matter, supporting microbial activity, and reducing reliance on high-emission agricultural inputs. Its ecological role extends beyond food security into climate mitigation. (Atthawala 2022, Handa 2017)

Climate & Soil Requirements

It shows best growth at 25–30°C, tolerates up to 40°C. Frost is lethal. It Thrives in low rainfall areas; highly drought-resistant. It prefers sandy loam or lateritic soils, pH 6.0–7.5, well-drained. Further, it can grow in poor soils. *Macrotyloma uniflorum* (Horse Gram) plays an important ecological role as a hardy legume that improves soil fertility, supports biodiversity, and sustains farming systems in semi-arid regions. Its nitrogen-fixing ability, drought tolerance, and dual-purpose use (food + fodder) make it a keystone crop for ecological balance and sustainable agriculture. (Ashraf 2018, Prasad 2015)

In Ayurveda, Horse Gram (Horse Gram) is considered a powerful pulse with *ushna virya* (hot potency), making it effective for dissolving kidney stones, balancing kapha-related disorders, and aiding weight loss. It is prescribed for urolithiasis, obesity, piles, and metabolic imbalances. Horse gram is renowned in Ayurveda and folk medicine It is a remedy in kidney stones as decoctions or soups made from Horse Gram are believed to help dissolve or flush out kidney stones. Further, Its high fiber content aids digestion and detoxification. In addition, low in fat but rich in protein, making it a good option for those seeking balanced nutrition. (Bhartiya 2015) *Macrotyloma uniflorum* (Horse Gram) shows promising anti-diabetic and anti-obesity effects, supported by both traditional Ayurvedic use and modern scientific studies. Its bioactive compounds help regulate blood glucose, improve lipid metabolism, and reduce fat accumulation, making it a potential functional food for managing metabolic disorder. Further, Horse Gram is considered a pulse with strong *ushna virya* (heating potency) and *laghu guna* (lightness), which makes it effective in balancing certain doshas. Its properties are particularly useful for Kapha-related imbalances, while it must be moderated in Pitta conditions. (Shah 2014, Chakraborty 2018, Ahmad 2016, Yadav 2020)

Nutritional Profile

Horse Gram (*Macrotyloma uniflorum*, Horse Gram) is traditionally valued as an energy booster because of its high protein, iron, and complex carbohydrate content. In Ayurveda and folk diets, it is considered a strengthening pulse that sustains energy levels, especially in cold climates and physically demanding lifestyles. In fact, Horse Gram's reputation as an energy booster is deeply tied to its dense protein, iron, and complex carbohydrates, which release energy slowly and steadily. This makes it ideal for sustaining stamina in cold climates or during physically demanding lifestyles like farming, trekking, or mountain living. Ayurveda classifies Horse Gram as a "balya" (strength-giving) pulse, often recommended for people recovering from illness or needing resilience against fatigue. Its warming nature also aligns with traditional diets in the Himalayas,

where food is expected not just to nourish but to fortify the body against harsh conditions. (Rlds 2017, Sralkar 2013, Ingle 2020)

Protein Content, one of the standout features of Horse Gram is its protein content, which ranges between 20–25%. That's significantly higher than many other pulses such as green gram (mung bean) or cowpea. This makes Horse Gram not just a staple of traditional diets but also a powerhouse for muscle building, energy sustenance, and nutritional resilience in communities that rely on it. Its dense protein profile, combined with iron and complex carbohydrates, explains why Ayurveda and folk traditions classify it as a strengthening pulse — ideal for cold climates and physically demanding lifestyles. In fact, this high protein density is one reason Horse Gram is often recommended for vegetarian diets, where pulses are the primary source of protein. (Roy 2010) It has high protein levels of protein, higher than many other pulses like green gram or cowpea. Further, provides lysine and tryptophan, essential amino acids, important for muscle repair and energy metabolism. It is plant-based protein source which is Ideal for vegetarian and vegan diets. Further, High in iron, calcium, and phosphorus, preventing anemia and strengthening bones. (Lalitha 2020, Vashistha 2021)

Mineral Profile

Horse Gram (Horse Gram, *Macrotyloma uniflorum*) is not only prized for its protein density but also for its rich mineral composition that makes it a true strengthening pulse. With protein levels ranging between 20–25%, it surpasses many other pulses like green gram and cowpea, making it an excellent source of plant-based nutrition for communities that rely on vegetarian diets. Alongside this, its mineral profile adds another layer of health benefits. The iron content supports hemoglobin formation, helping prevent anemia and ensuring sustained energy levels, which is why Horse Gram is often recommended for those recovering from illness or fatigue. Its calcium strengthens bones and teeth while also aiding muscle function, a crucial factor in physically demanding lifestyles such as farming or trekking in the Himalayan terrain. Meanwhile, phosphorus works in synergy with calcium to maintain bone health and plays a vital role in energy metabolism, ensuring that the body can efficiently convert nutrients into stamina and resilience. Together, this combination of high protein and essential minerals makes Horse Gram a holistic food that embodies both nutritional science and Ayurvedic wisdom. It is considered "balya" in Ayurveda,a strength-giving pulse, and is traditionally consumed in cold climates to fortify the body against harsh conditions. By sustaining energy, supporting bone strength, and preventing deficiencies, Horse Gram stands out as a cornerstone of Uttarakhand's traditional diet, reflecting the deep connection between local foods and the health needs of mountain communities. (Sudha 2023, Sarvani 2020, Rizvi 2022, Biswal 2023)

Fiber Content

It is rich in soluble fiber which helps lower cholesterol and regulate blood sugar. It contains insoluble fiber which Promotes bowel regularity and prevents constipation. Further it keeps you full longer, aiding in weight management. In addition antioxidants such as Polyphenols and flavonoids protect against oxidative stress and inflammation. Contains phenolic acids, flavonoids, tannins, saponins, and phytosterols, contributing to antioxidant and anti-inflammatory properties. (Herath 2020, Moktan 2015)

Natural Weight Management: Horse Gram (*Macrotyloma uniflorum*, Horse Gram) also plays a valuable role in natural weight management. Its high protein and dietary fibre work together to reduce levels of the hunger hormone ghrelin, extending satiety and preventing overeating. This slow-release energy mechanism not only sustains stamina but also helps regulate appetite, making Horse Gram a supportive food for those aiming to maintain or reduce weight naturally. In Ayurveda, Horse Gram is traditionally considered a "heating food" (*ushna guna*), meaning it increases metabolic heat and supports fat burn. This warming quality is especially valued in cold Himalayan climates, where foods are expected to energize and fortify the body while also aiding digestion and metabolism. (Sundaram 2013) By combining modern nutritional science with ancient wisdom, Horse Gram emerges as a pulse that not only strengthens bones and muscles but also helps balance body weight through natural appetite control and enhanced metabolic activity. That way, your collection will present Horse Gram as a truly holistic food — strengthening, healing, and balancing. (Muthukumar 2014) The combination of high protein and fibre reduces levels of the hunger hormone (ghrelin), extending satiety and preventing overeating. It is traditionally classified as a "heating food" in Ayurveda, meaning it increases metabolic heat to support fat burn. (Mohan 2011, Mandle 2012, Gopalan 2023)

Dissolving Kidney Stones: Renowned in traditional medicine for its strong diuretic properties, it contains bioactive compounds that help prevent and break down calcium oxalate kidney stones. *Macrotyloma uniflorum* (Horse Gram) has long been valued in traditional medicine for its role in managing kidney stones. Its diuretic properties, high antioxidant content, and ability to reduce urinary crystallization make it a supportive dietary option for preventing and alleviating stone formation. (Tovey 2011) The pulse contains bioactive compounds that actively prevent and break down calcium oxalate stones, the most common type of kidney stone. In addition, its high antioxidant content supports urinary tract health by reducing oxidative stress, while its ability to minimize urinary crystallization makes it a supportive dietary option for both prevention and alleviation of stone-related discomfort. (Singh 2022, Chakraborty 2016, Sree 2014)

This therapeutic use of Horse Gram reflects the deep wisdom of Himalayan folk diets and Ayurveda, where food is seen not just as nourishment but as medicine. Consuming Horse Gram in forms *Fanu* is believed to cleanse the urinary system, sustain energy, and fortify the body against recurring stone formation. Its dual role as a nutritional powerhouse and a kidney-protective food makes it one of Uttarakhand's most valued pulses, embodying the principle that local foods can provide both strength and healing. (Arya 2025)

Blood Sugar Regulation: *Macrotyloma uniflorum* (Horse Gram) has notable benefits in blood sugar regulation, making it a valuable dietary option for people at risk of or living with diabetes. Its bioactive compounds, fiber, and protein content work together to stabilize glucose metabolism. With a low glycemic index, it slows down carbohydrate absorption, preventing sudden blood glucose spikes and enhancing insulin sensitivity. (Gupta 2011)

Low Fat & Low Glycemic Index (GI): *Macrotyloma uniflorum* (Horse Gram) is widely recognized for its fat-lowering properties, making it a valuable dietary pulse in weight management and metabolic health. Its bioactive compounds, fiber, and protein content work synergistically to reduce fat absorption and improve lipid metabolis Contains minimal lipids (around 1%) and slowly digestible carbohydrates. *Macrotyloma uniflorum* (Horse Gram) is highly effective in weight management diets thanks to its fat-lowering, high-fiber, and protein-rich profile. It is traditionally used in Indian diets for obesity control and is now gaining recognition as a functional food for modern weight-loss programs.

Macrotyloma uniflorum (Horse Gram) has significant potential in maternal health programs due to its nutrient density, affordability, and resilience. It can help address anemia, protein-energy malnutrition, and micronutrient deficiencies among pregnant and lactating women. *Macrotyloma uniflorum* (Horse Gram) is a powerful ally in combating anemia due to its exceptionally high iron content, bioactive compounds that enhance hemoglobin formation, and affordability for rural diets. When integrated into maternal health and public nutrition programs, it can significantly reduce iron-deficiency anemia among women and children. (Misra 2011)

Cardiovascular & Liver Support: *Macrotyloma uniflorum* (Horse Gram) has notable cardioprotective properties, making it a promising dietary pulse for heart health. Its nutrient profile and bioactive compounds help regulate cholesterol, improve lipid metabolism, and reduce oxidative stress—all key factors in cardiovascular disease prevention. Packed with antioxidants, polyphenols, and flavonoids, horse gram binds to bad (LDL) cholesterol to help flush it out, reducing the risk of arterial blockages.

Its cardioprotective effects are complemented by its ability to reduce oxidative stress, a key factor in preventing cardiovascular diseases. This antioxidant-rich profile also extends benefits to the liver, where it aids in detoxification and supports healthy metabolic function. In traditional diets, Horse Gram is often consumed not only for strength and stamina but also as a natural safeguard against lifestyle-related conditions such as high cholesterol and fatty liver disease. (Ramasamy 2017, Petimani 2019, Zhu 2018)

By combining its protein density, mineral richness, and therapeutic bioactive compounds, Horse Gram stands out as a holistic food that nourishes, strengthens, and protects vital organs.

It embodies the Himalayan wisdom of using local pulses not just for sustenance but also for long-term resilience against chronic diseases. (Oli 2024)

Potential Side Effects & Considerations

Excessive Body Heat: Horse Gram (*Macrotyloma uniflorum*, Horse Gram) is deeply nourishing, but

traditional wisdom also cautions against overconsumption due to its potent thermogenic nature. Classified as a "heating food" in Ayurveda, it can generate excess internal heat in the body. When taken in large amounts, this may lead to mouth ulcers, gastric discomfort, or a general feeling of excessive body warmth, especially in individuals with sensitive constitutions. This highlights the balance emphasized in Himalayan diets: while Horse Gram is a strength-giving pulse with benefits for energy, kidney health, weight management, and cardiovascular support, it must be consumed mindfully. Moderation ensures that its warming qualities fortify the body without tipping into imbalance. Due to its potent thermogenic ("heating") nature, overconsumption may cause a feeling of excess internal heat, mouth ulcers, or gastric discomfort in individuals with sensitive body types. (Ojha 2020, Auxilla 2013)

Not Recommended during Pregnancy/Bleeding Disorders: Horse Gram (*Macrotyloma uniflorum*, Horse Gram) is a powerhouse pulse, but traditional wisdom also emphasizes caution in certain conditions. Because of its blood-thinning properties and its classification as a heating food in Ayurveda, it is generally not recommended during pregnancy. The same caution applies to individuals suffering from bleeding disorders, heavy menstrual bleeding, or frequent nasal drops/epistaxis, as Horse Gram may aggravate these conditions. (Kumar 2019)

This highlights the dual nature of Horse Gram: while it is deeply nourishing and protective for energy, kidney health, and cardiovascular support, it must be consumed mindfully depending on individual health states. In Himalayan folk diets, such nuances are always respected — foods that fortify in one context may require moderation or avoidance in another. Its blood-thinning and heating properties mean it should generally be avoided by pregnant women or individuals suffering from heavy menstrual bleeding and nasal drops. (Ramasinghe 2017)

Hyperacidity: While Horse Gram (*Macrotyloma uniflorum*, Horse Gram) is celebrated for its strength-giving and therapeutic properties, it does carry certain cautions in traditional practice. People suffering from hyperacidity or severe gastric ulcers are generally advised to avoid it, as its "heating" nature in Ayurveda can aggravate stomach acid and worsen discomfort. This highlights the dual character of Horse Gram: while it is deeply nourishing and protective for energy, kidney health, and cardiovascular support, it may not be suitable for those with sensitive digestive conditions. People suffering from severe gastric ulcers should avoid it, as it can aggravate stomach acid (Hamid 2009, Singh 2012, Panda 2015)

Recent nutritional research confirms that Horse Gram (*Macrotyloma uniflorum*) is a protein-rich, antioxidant-packed legume with significant therapeutic potential, especially for managing kidney stones, diabetes, obesity, and cardiovascular health. It is considered an underutilized "functional food" with bioactive compounds that support metabolic balance. Neglect in modern diets**:** Despite its resilience, horse gram is underutilized compared to lentils and chickpeas. Commercial potential of Horse Gram needs promotion as a functional food and inclusion in value-added products. *Macrotyloma uniflorum* (Horse Gram) has strong potential to be integrated into public nutrition programs, especially in regions facing malnutrition, hidden hunger, and climate stress. Its affordability, resilience, and nutritional richness make it a strategic crop for government-led food initiatives. *Macrotyloma uniflorum* (Horse Gram) can be a game-changer in school feeding programs, especially in regions where malnutrition and anemia are prevalent.

Its affordability, resilience, and nutrient density make it an ideal addition to midday meals and community-based nutrition initiatives. *Macrotyloma uniflorum* (Horse Gram) can be transformed into fortified foods that directly support nutrition programs and maternal health initiatives. Its high iron, protein, and calcium content make it ideal for combating anemia and malnutrition when processed into accessible, culturally familiar product.

Conflict of Interests

Authors declare no competing interests.

Author Contributions

Akhil Gupta: Investigation, formal analysis, writing—original draft. Kuldeep: Validation, methodology, writing—reviewing.

Data Availability

The datasets generated during and/or analyzed during the

current study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

Conflict of Interest The authors declare no competing interests.

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