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Black sweet potato: A rich source of phytochemicals with therapeutic applications

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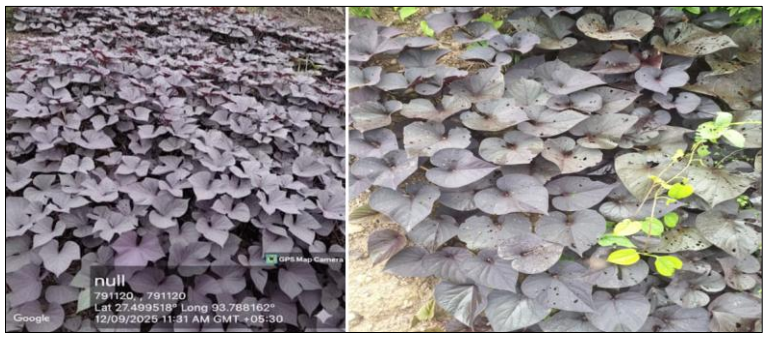
Abstract
Black sweet potato (*Ipomoea batatas*) is a nutrient-dense root vegetable known for its high anthocyanin content, particularly in dark purple to black varieties. This review explores the phytochemical composition and therapeutic potential of black sweet potato, highlighting its antioxidant, anti-inflammatory, anticancer, antidiabetic, and antimicrobial properties. The bioactive compounds present, such as anthocyanins, flavonoids, phenolic acids, and carotenoids, contribute to its health-promoting effects. Cultivation of black sweet potato can also provide economic and nutritional benefits for farmers. These findings suggest that black sweet potato is a valuable functional food with significant pharmacological and agricultural relevance.

Keywords: Black sweet potato, *Ipomoea batatas*, phytochemicals, anthocyanins, therapeutic applications, functional food

Introduction
Sweet potatoes (*Ipomoea batatas*) are widely consumed globally, with different cultivars exhibiting various colours and nutritional profiles. Among these, black sweet potatoes are notable for their deep purple to black flesh, rich in anthocyanins-water-soluble pigments known for potent antioxidant properties (Ćetković, 2025) [1].
These bioactive compounds not only give the tuber its colour but also provide multiple health benefits, including antioxidant, anti-inflammatory, anticancer, and antidiabetic properties (Mbaeyi and Emejulu, 2013) [2].
In addition to anthocyanins, black sweet potatoes contain flavonoids, phenolic acids, and carotenoids that enhance their nutritional and functional profile. As research advances, the role of black sweet potato as a natural source of antioxidants and bioactive compounds is gaining importance in both human health and agricultural sustainability.



Phytochemical Composition
Black sweet potatoes are rich in various bioactive compounds:

1. **Anthocyanins:** These are the primary pigments responsible for the black coloration. They possess strong antioxidant and anti-inflammatory properties, helping reduce oxidative stress and lower the risk of chronic diseases.
2. **Flavonoids:** Compounds such as quercetin and kaempferol exhibit antioxidant, anti-inflammatory, and anticancer activities.
3. **Phenolic Acids:** Chlorogenic acid, a major phenolic acid, lows antioxidant effects and may help manage blood sugar levels.

4. **Carotenoids:** β-carotene acts as a precursor to vitamin A, supporting immune and eye health.

Studies comparing different sweet potato varieties revealed that both roots and leaves exhibit significant variations in total phenolics and β-carotene, with black-fleshed cultivars showing higher antioxidant potential (Hapke *et al*., 2024) [3].

Therapeutic Applications

1. Antioxidant Properties

Anthocyanins and other polyphenolic compounds neutralize free radicals, reducing oxidative stress and the risk of chronic diseases like cardiovascular and neurodegenerative disorders.

Recent comparative studies show that antioxidant activity is strongly correlated with anthocyanin and phenolic content across cultivars.

2. Anti-inflammatory Effects

Bioactive compounds in black sweet potatoes modulate inflammatory pathways and reduce pro-inflammatory cytokine production, contributing to the management of chronic inflammatory conditions.

3. Anticancer Potential

Extracts from black sweet potatoes inhibit cancer cell proliferation and induce apoptosis, largely due to anthocyanins and flavonoids.

4. Antidiabetic Effects

Chlorogenic acid and other phenolics improve insulin sensitivity and regulate blood glucose levels, making black sweet potato beneficial for type 2 diabetes management.

5. Antimicrobial Activity

Extracts exhibit antimicrobial properties against various bacterial and fungal pathogens, indicating potential for food preservation and natural antimicrobial applications.

6. Functional and Industrial Applications

Beyond therapeutic use, anthocyanins from black sweet potato have gained attention for use in biopolymer-based smart packaging and functional foods, due to their colour stability and bioactive potential. These applications expand the commercial value of the crop and encourage sustainable utilization. (Yun *et al*., 2024) [4].

Conclusion and Practical Implications

Black sweet potato (*Ipomoea batatas*) is a nutritionally and pharmacologically rich crop with multiple bioactive compounds that contribute to antioxidant, anti-inflammatory, anticancer, antidiabetic, and antimicrobial properties. Its adaptability to varied agro-climatic conditions makes it a valuable addition to sustainable farming systems.

From an agricultural perspective, promoting black sweet potato cultivation can enhance farmer income and contribute to food and nutritional security. Further studies on optimal cultivation and processing methods will improve its use in both therapeutic and industrial applications such as smart packaging and functional foods.

During field visits, it was observed that black sweet potato cultivation requires moderate care and can adapt to various soil type, suggesting its potential for wider adaptation in local farm communities.

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