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Role of the Nutraceutical and Functional Food Applications of Golden Sweet Potato

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Abstract : *Golden sweet potato, commonly associated with orange-fleshed sweet potato, is an important nutrient-rich root crop with considerable potential for nutraceutical and functional food applications. It contains essential nutrients, including carbohydrates, dietary fibre, vitamins, minerals, carotenoids, phenolic compounds, and other biologically active substances. Its characteristic golden-orange colour is primarily associated with beta-carotene, a provitamin A carotenoid that contributes to vitamin A nutrition. The increasing interest in natural, plant-based functional foods has created opportunities for incorporating golden sweet potato into bakery products, beverages, breakfast cereals, infant foods, snacks, nutritional supplements, and other value-added food products. Its antioxidant compounds and dietary fibre further increase its importance in nutritional product development.*

Keywords: Golden Sweet Potato, Nutraceuticals, Functional Foods, Beta-Carotene, Antioxidants, Vitamin A, Food Processing, Nutritional Health.

1. INTRODUCTION

Sweet potato (Ipomoea batatas L.) is an important root and tuber crop cultivated in tropical and subtropical regions. It is widely consumed because of its nutritional value, adaptability to different climatic conditions, and versatility in food preparation. Among the different varieties, golden or orange-fleshed sweet potato has received considerable attention because of its attractive colour and high concentration of carotenoids, particularly beta-carotene. Beta-carotene is converted into vitamin A in the human body and plays an important role in maintaining normal vision, immune function, growth, and cellular development (Neela & Fanta, 2019).

The growing demand for healthy and naturally enriched foods has increased the importance of nutraceuticals and functional food ingredients. Functional foods are foods that provide nutritional benefits beyond their basic contribution to energy and essential nutrients. Nutraceutical applications involve the development and utilisation of food-derived components that may provide additional physiological benefits. Golden sweet potato represents a promising raw material for both applications because it contains carotenoids, dietary fibre, vitamin C, minerals, and phenolic compounds.

The golden-orange flesh indicates the presence of carotenoid pigments, although their concentrations vary according to cultivar, growing conditions, maturity, and storage practices. These compounds contribute to the nutritional and functional characteristics of the crop. Neela and Fanta (2019) highlighted the importance of orange-fleshed sweet potato as a dietary source of provitamin A and discussed its potential for developing different nutritional food products. Similarly, Laveriano-Santos (2022) reviewed the phytochemical composition and biological activities of sweet potato and emphasised the influence of processing on its bioactive compounds.

Golden sweet potato can be consumed directly or processed into flour, puree, starch, powder, juice, bakery ingredients, and nutritional formulations. Its natural sweetness and attractive colour make it suitable for developing healthier food products. Therefore, investigating its nutraceutical and functional food applications is important for food innovation, nutritional security, agricultural development, and the promotion of healthier dietary patterns.

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II. NUTRITIONAL COMPOSITION OF GOLDEN SWEET POTATO

Golden sweet potato contains a combination of macronutrients and micronutrients that contribute to its nutritional importance. Carbohydrates constitute its major energy-producing component, while dietary fibre supports digestive health. Its vitamin and mineral composition further enhances its suitability for developing nutrient-rich food products.

The most important nutritional component is beta-carotene, which acts as a precursor of vitamin A. The concentration of beta-carotene differs significantly among sweet potato varieties. Orange-fleshed varieties generally contain substantially higher quantities than white-fleshed varieties. The crop also contains vitamin C, potassium, magnesium, calcium, and several phenolic compounds. These nutrients contribute to its potential role in improving dietary quality and addressing micronutrient deficiencies (Neela & Fanta, 2019).

Table 1. Major Nutritional and Bioactive Components of Golden Sweet Potato

Nutritional component	Major characteristics	Nutritional importance
Beta-carotene	Provitamin A carotenoid	Supports vitamin A nutrition and normal vision
Dietary fibre	Soluble and insoluble fibre	Supports digestive health
Vitamin C	Water-soluble antioxidant vitamin	Contributes to normal immune function
Potassium	Essential mineral	Supports normal muscle and nerve function
Magnesium	Essential mineral	Participates in energy metabolism
Calcium	Structural mineral	Contributes to bone health
Phenolic compounds	Plant-derived bioactive compounds	Contribute to antioxidant activity
Flavonoids	Phytochemical compounds	Contribute to the antioxidant potential
Carbohydrates	Mainly starch and natural sugars	Provide dietary energy
Resistant starch	Depends on cultivar and processing	May contribute to colonic fermentation

III. NUTRACEUTICAL PROPERTIES OF GOLDEN SWEET POTATO

1. Beta-Carotene and Vitamin A Nutrition

The most important nutraceutical characteristic of golden sweet potato is its high beta-carotene content. Beta-carotene is converted into vitamin A through metabolic processes in the human body. Vitamin A is essential for maintaining normal eyesight, epithelial tissues, immune responses, and healthy growth. Inadequate vitamin A intake can contribute to night blindness, impaired immune function, and other nutritional complications.

Golden sweet potato offers a food-based approach to improving vitamin A intake, particularly in developing countries where micronutrient deficiencies remain a nutritional concern. Van Jaarsveld (2005) demonstrated that regular consumption of beta-carotene-rich orange-fleshed sweet potato improved vitamin A status among primary school children in South Africa. Therefore, the crop has potential applications in school feeding programmes, community nutrition initiatives, and supplementary food development.

2. Antioxidant Properties

Golden sweet potato contains carotenoids, phenolic acids, flavonoids, and vitamin C, which contribute to its antioxidant properties. Antioxidants participate in the protection of biological molecules against oxidative damage by neutralising reactive oxygen species and other free radicals.

The antioxidant potential of sweet potato depends on its variety, cultivation conditions, storage, and processing methods. Laveriano-Santos (2022) reported that sweet potato contains diverse phytochemicals with biological activities. These characteristics make golden sweet potato a promising ingredient for developing antioxidant-rich food products. However, laboratory antioxidant activity should not automatically be interpreted as proof of disease prevention in humans.

3. Dietary Fibre and Digestive Health

Dietary fibre is another important component of golden sweet potato. Fibre contributes to normal bowel function, supports digestive processes, and can help improve the nutritional quality of everyday meals. Depending on the cultivar and processing conditions, sweet potato may also contain resistant starch, which can resist digestion in the small intestine and undergo fermentation in the large intestine.

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The incorporation of golden sweet potato flour into bakery products, breakfast cereals, and traditional food preparations can increase dietary fibre intake. Its application in fibre-enriched food formulations is particularly important for developing nutritious alternatives to highly refined cereal products.

IV. FUNCTIONAL FOOD APPLICATIONS OF GOLDEN SWEET POTATO

Golden sweet potato has considerable potential in the functional food industry because of its nutritional composition, natural colour, sweetness, and suitability for different processing techniques. It can be incorporated into various food products to improve their nutritional value and consumer acceptability.

1. Bakery and Confectionery Products

Golden sweet potato flour can be used in the preparation of bread, biscuits, cookies, cakes, muffins, pastries, and other bakery products. Replacing a proportion of refined wheat flour with sweet potato flour can improve the nutritional characteristics and natural colour of these products. Its natural sweetness may also reduce the need for additional sugar in certain formulations.

Sweet potato flour can contribute carotenoids and dietary fibre to bakery products. However, its incorporation level must be optimised to maintain desirable texture, taste, volume, and consumer acceptance.

2. Functional Beverages and Juices

Golden sweet potato can be processed into juices, smoothies, purees, and nutritional beverages. Its natural orange colour provides an attractive appearance, while its carotenoid content increases its nutritional value. Combining sweet potato with milk, fruit extracts, and other plant-based ingredients can produce innovative beverage formulations.

These products may be particularly useful in school nutrition programmes and supplementary dietary products. Appropriate pasteurisation, packaging, and storage technologies are necessary to maintain product quality and safety.

3. Infant and Complementary Foods

Golden sweet potato has considerable potential in complementary food formulations for infants and young children. Its beta-carotene content makes it a valuable ingredient for improving provitamin A intake. It can be incorporated into infant purees, porridge, blended cereal products, and nutrient-enriched formulations.

The use of orange-fleshed sweet potato in food-based nutrition programmes has been investigated in several African countries. Its incorporation into locally available complementary foods may support dietary diversification and micronutrient intake. Nevertheless, infant products must meet appropriate nutritional, microbiological, and food safety standards.

4. Nutritional Snacks and Ready-to-Eat Products

Golden sweet potato can be transformed into chips, crisps, baked snacks, extruded products, energy bars, and dried snack formulations. These products provide opportunities for developing convenient foods using naturally nutrient-rich agricultural ingredients.

Baked and air-fried sweet potato snacks may offer alternatives to conventional deep-fried snacks. Product developers should consider oil content, moisture, texture, carotenoid retention, and storage stability while developing these products.

5. Flour, Starch, and Powder-Based Products

Dehydrated golden sweet potato can be converted into flour and powder for commercial food applications. Sweet potato flour can be incorporated into noodles, pasta, soups, sauces, breakfast cereals, and traditional food preparations.

Sweet potato starch also has applications as a thickening, binding, and texturising ingredient. These products can increase the commercial utilisation of sweet potato and reduce post-harvest losses by converting fresh roots into shelf-stable ingredients.

Table 2. Major Functional Food Applications of Golden Sweet Potato

Functional food category	Product examples	Major nutritional contribution
Bakery products	Bread, biscuits, cakes, muffins	Beta-carotene and dietary fibre
Beverages	Juice, smoothies, nutritional drinks	Carotenoids and vitamins
Infant foods	Purees, porridge, cereal blends	Provitamin A and energy
Snack products	Chips, crisps, baked snacks	Carotenoids and carbohydrates

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Breakfast foods	Breakfast cereals, flakes	Dietary fibre and micronutrients
Flour products	Noodles, pasta, composite flour	Energy and carotenoids
Dairy-based foods	Yoghurt blends, milk-based desserts	Natural colour and carotenoids
Nutritional products	Fortified food blends and powders	Micronutrient enrichment

V. COMMERCIAL AND INDUSTRIAL IMPORTANCE

The growing demand for natural ingredients and plant-based nutritional products has created opportunities for the commercial development of golden sweet potato. Food manufacturers can utilise its flour, starch, puree, and carotenoid-rich ingredients in different product categories.

The crop also provides opportunities for small-scale food processing enterprises, farmer-producer organisations, and agricultural entrepreneurs. Value addition through dehydration, flour production, snack manufacturing, and beverage preparation can increase the economic value of harvested roots.

In developing countries, the integration of golden sweet potato into food processing industries can support rural employment, agricultural diversification, and local food supply chains. In India, its potential can be explored through the development of regionally acceptable bakery products, nutritious snacks, complementary foods, and fortified cereal blends.

However, successful commercialisation requires consistent raw material quality, standardised processing methods, food safety management, suitable packaging, and consumer awareness.

VI. CONCLUSION

Golden sweet potato (Ipomoea batatas L.) is a promising agricultural and nutritional resource with significant potential for nutraceutical and functional food applications. Its high beta-carotene content, dietary fibre, vitamins, minerals, and phytochemical compounds make it a valuable ingredient for developing nutrient-rich food products. Its application in bakery products, beverages, infant foods, nutritional snacks, breakfast cereals, and flour-based formulations provides opportunities for improving food quality and dietary diversity.

The available scientific evidence highlights its importance in supporting vitamin A nutrition and improving the nutritional characteristics of commonly consumed foods. Appropriate processing and preservation technologies can further improve its commercial usefulness while maintaining important nutritional components. However, additional research is necessary to establish its long-term health effects, optimise processing conditions, improve product stability, and expand its industrial applications. Golden sweet potato has considerable potential to contribute to nutritional security, functional food innovation, agricultural development, and sustainable food processing.

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