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Medicinal properties of Cape gooseberry (*Physalis peruviana* L.)

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Abstract

Cape gooseberry (*Physalis peruviana* L.) is an emerging functional fruit crop recognized for its high nutritional value and wide-ranging medicinal properties. The fruit is rich in essential vitamins, particularly A and C, along with minerals, dietary fiber, and important bioactive compounds such as polyphenols, flavonoids, and with anolides. These phytochemicals impart strong antioxidant, anti-inflammatory, antimicrobial, antidiabetic, and immunomodulatory activities. Regular consumption of Cape gooseberry has been associated with improved digestion, better regulation of blood glucose levels, enhanced cardiovascular health, improved vision, and strengthened immune response. Traditionally, the fruit and other plant parts have been used in the management of various ailments including fever, asthma, liver disorders, and skin diseases, indicating its significant therapeutic potential. Owing to its nutritional richness and pharmacological benefits, Cape gooseberry holds promise as a valuable crop for functional foods, nutraceuticals, and value-added products. Increased awareness, systematic cultivation, and further scientific research are essential to fully harness its health-promoting properties and expand its utilization in sustainable agriculture and human nutrition.

Keywords: antioxidants, bioactive compounds, functional fruit, nutraceuticals.

Introduction

Cape gooseberry (*Physalis peruviana L.*), also known as goldenberry, Inca berry, rasbhari, or poha berry, is a small, orange-colored fruit encased in a distinctive papery husk. Botanically a member of the nightshade family (Solanaceae), it is native to the Andean regions of South America and valued both as a food and a traditional medicinal plant. Unlike true gooseberries, it belongs to the *Physalis* genus and has a long history of use in regional folk medicine as well as growing scientific interest for its nutritional and therapeutic potential. Rich in bioactive compounds such as vitamins (especially vitamin C and provitamin A), polyphenols, carotenoids, and withanolides, Cape gooseberry has been studied for its antioxidant, anti-inflammatory, metabolic, and immunomodulatory effects. These phytochemicals are thought to help the body combat oxidative stress, a key driver of chronic diseases, and support various aspects of human health. In traditional medicinal systems across South America and beyond, the fruit, juice, and extracts of *Physalis peruviana* have been used to support immune function, digestive health, liver and kidney wellness, heart health, and inflammatory conditions. While many of these uses are rooted in folk practices, modern nutritional and pharmacological research continues to explore and validate the medicinal properties of this versatile fruit, positioning it as both a nutritious food and a promising functional ingredient in health-promoting diets.

Origin

Cape gooseberry is native to the Andean region of South America, particularly in countries such as Peru, Ecuador, Colombia, and Chile. It was known and used in these regions for centuries and likely featured in *Inca* agriculture before spreading globally. The common English name "Cape gooseberry" doesn't reflect its actual origin. It likely came from the fruit's widely cultivated presence in the Cape of Good Hope region of South Africa during the 19th century, where early settlers grew it extensively, giving rise to the name.

Distribution

Physalis peruviana is cultivated and naturalized worldwide across tropical, subtropical, and temperate regions. It is grown in Africa, Asia, Europe, North and South America, Australia, New Zealand, the Pacific islands, and parts of the United States.

Botanical Classification of Cape Gooseberry (*Physalis peruviana*)

Kingdom: Plantae (plants)

Phylum / Division: Tracheophyta / Magnoliophyta (vascular flowering plants)

Class: Magnoliopsida (dicotyledons)

Order: Solanales (includes nightshades and related plants)

Family: Solanaceae (nightshade family)

Genus: *Physalis* (ground cherries and related husk-fruited plants)

Species: *Physalis peruviana* L. (Cape gooseberry)

Bioactive Compounds in Cape Gooseberry: Vitamins & Carotenoids

Vitamin C (ascorbic acid) potent antioxidant supporting immune function and cellular health.

β-Carotene (provitamin A) contributes antioxidant activity and supports vision and skin health.

Phenolic Compounds: These are plant-derived antioxidants with anti-inflammatory, cardioprotective, and metabolic effects:

Gallic acid major phenolic in the fruit with strong antioxidant actions.

Chlorogenic acid, caffeic acid, ferulic acid, p-coumaric acid common phenolic acids with antioxidant and potential metabolic benefits.

Flavonoids: Plant pigments with antioxidant, anti-inflammatory, and enzyme-modulating properties:

Quercetin known for antioxidant and heart-health effects.

Kaempferol may offer anti-inflammatory and metabolic support.

Rutin, myricetin, catechin, epicatechin other flavonoids with diverse health effects.

Beneficial Activities of Bioactive Compounds in Cape Gooseberry

Antioxidant: These antioxidants protect cells and tissues from damage by reactive oxygen species. Cape gooseberry is recognized for its significant antioxidant properties, largely due to its high content of vitamin C, polyphenols, flavonoids, and carotenoids. These bioactive compounds are effective at scavenging free radicals and reducing oxidative stress, which helps protect cells from damage linked to aging and chronic diseases like heart disease and diabetes. Studies using methods such as ABTS and DPPH assays show that the fruit has a strong antioxidant capacity, with notable levels of vitamin C (around 47–52 mg per 100 g) and total polyphenols, contributing to its nutraceutical potential. Additionally, research indicates that antioxidant enzymes in tissues can be enhanced by Cape gooseberry juice, helping combat oxidative injury in experimental models. In summary, the antioxidant activity of Cape gooseberry supports its role as a functional food with potential benefits in reducing oxidative stress and improving overall health.

Anti-Inflammatory Effects*:* Extracts from the fruit and calyx exhibit reducing inflammatory mediators and cytokines such as TNF-α and interleukins in experimental models. This suggests potential benefits in inflammatory conditions, including gut inflammation. Cape gooseberry exhibits notable anti-inflammatory activity, largely attributed to its rich profile of bioactive compounds such as with anolides, flavonoids, and sucrose esters. Experimental studies using extracts from the fruit and calyces (the papery husk) have shown significant

reductions in key inflammatory markers like IL-1β, IL6, COX-2, and iNOS in laboratory and animal models of inflammation, including chemically induced colitis in rats. These extracts also inhibit nitric oxide release from activated immune cells and attenuate inflammatory gene expression, suggesting mechanisms that modulate inflammatory pathways such as NF-KB signaling. Together, these findings support the traditional use of Cape gooseberry in reducing inflammation and indicate its potential as a natural anti-inflammatory agent, though most evidence remains preclinical.

Antidiabetic and Metabolic Support: Bioactive compounds in Cape gooseberry can inhibit carbohydrate-digesting enzymes like α-glucosidase, potentially helping slow glucose absorption and support better blood sugar control a desirable effect in diabetes management. Cape gooseberry has shown metabolic benefits in preclinical research. Extracts from the fruit and calyces have been found to lower blood glucose levels and improve glucose tolerance in diabetic animal models, helping regulate hyperglycemia and thereby supporting metabolic balance. Additionally, studies report that regular consumption of golden berry in obese, hyperglycemic rats reduced insulin resistance, improved lipid profiles (including cholesterol and triglycerides), and helped normalize markers linked to metabolic syndrome, indicating support for both glucose and lipid metabolism. Leaf and fruit extracts also showed reduced postprandial blood glucose and enhanced insulin activity, suggesting potential roles in managing high blood sugar and promoting healthier metabolic responses.The antidiabetic effects are attributed to bioactive compounds such as flavonoids, phenolic acids, and antioxidants that influence insulin signaling, carbohydrate metabolism, and oxidative stress pathways.

Antimicrobial Activity: Cape gooseberry fruit extracts have demonstrated antibacterial effects against both Gram-positive and Gram-negative bacteria, suggesting a role in supporting immune defense and food preservation applications. Cape gooseberry exhibits notable antimicrobial properties against a range of bacteria and fungi, thanks to its rich content of flavonoids, phenols, tannins, and other phytochemicals. *Staphylococcus aureus*, *Bacillus cereus*, *Escherichia coli*, and *Pseudomonas syringae*, with measurable inhibitory concentrations in laboratory tests. These compounds can interfere with bacterial cell walls and protein functions, disrupting growth and survival.In addition to antibacterial effects, Cape gooseberry extracts also show antifungal activity; ethanol extracts from plant parts can inhibit fungal growth such as *Penicillium digitatum*, suggesting potential use in managing fungal pathogens.Overall, while this activity has been observed in vitro and in experimental systems, it supports the potential of *Physalis peruviana* as a natural antimicrobial agent, with implications for food preservation and health applications.

Antiproliferative: Studies have shown that extracts from the fruit and calyx may inhibit the growth of certain cancer cell lines in vitro, indicating potential antiproliferative and chemo preventive properties. *Physalis peruviana* has demonstrated antiproliferative effects in laboratory studies, suggesting potential to inhibit the growth of cancer cells. In vitro research using extracts of the fruit and bioactive fractions has shown cytotoxic and growth-inhibiting activity against human cancer cell lines, including pancreatic and liver cancer cells. For example, an ethyl acetate-derived compound called magnolin, isolated from *P. peruviana*, exhibited strong antiproliferative action against human pancreatic cancer cells (PANC-1), with effects approaching those of standard chemotherapy agents but with lower toxicity toward normal human cells. This indicates a promising selective inhibitory effect on tumor cells. Earlier studies also reported that *P. peruviana* extracts reduced viability and induced cell cycle arrest and apoptosis (programmed cell death) in human hepatoma (liver cancer) cells, affecting mitochondrial function and increasing sub-G1 phase cell populations a marker of apoptotic cell death. Laboratory evidence also points to other phenolic and flavonoid constituents in Cape gooseberry

that may contribute to anticancer and antiproliferative activities, although most research remains preclinical (in vitro). In summary, Cape gooseberry contains bioactive compounds with demonstrated potential to inhibit cancer cell proliferation and promote apoptosis in lab studies, supporting further research into its antiproliferative properties.

Conclusion

Cape gooseberry is a highly nutritious and medicinally valuable fruit, rich in vitamins (especially A and C), minerals, dietary fiber, and bioactive compounds such as polyphenols, flavonoids, and with anolides. These constituents contribute to its strong antioxidant, anti-inflammatory, antimicrobial, antidiabetic, and immune-boosting properties. Regular consumption of Cape gooseberry may help in improving digestion, regulating blood sugar levels, supporting cardiovascular health, enhancing vision, and strengthening overall immunity. Its traditional use in managing ailments such as fever, asthma, liver disorders, and skin problems further highlights its therapeutic potential. Therefore, Cape gooseberry can be regarded as a functional fruit crop with promising applications in nutrition, medicine, and value-added products, emphasizing the need for greater awareness, cultivation, and research to fully exploit its health benefits

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