

Phytochemistry and Health Promoting Effect of Lemon (Citrus Limon): A Comprehensive Review

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Abstract

Lemon (*Citrus limon*) is globally recognised for its nutritional richness and therapeutic potential. It contains essential vitamins and minerals including niacin, riboflavin, thiamine, choline, pantothenic acid, folate, vitamin C, vitamin B6, calcium, copper, iron, manganese, magnesium, phosphorus, potassium, and zinc. It exhibits antibacterial, antifungal, anti-inflammatory, anticancer, depurative, and antiscorbutic activities, contributing to disease prevention and overall health maintenance. This review summarises the nutritional composition, phytochemical profile, and medicinal applications of lemon, with emphasis on its evidence-based health benefits.

Keywords: Citrus limon, Lemon, Citrus fruit, Nutritional benefits, Therapeutic uses

1. INTRODUCTION

Lemon is one of the most widely consumed citrus fruits worldwide, valued for its distinctive flavor, high vitamin C content, and broad therapeutic applications. Traditionally, it has been used in Ayurvedic and folk medicine for its depurative, antimicrobial, and digestive properties. Modern scientific research increasingly supports these uses, attributing the fruit's health-promoting effects to its abundant vitamin C, flavonoids, essential oils, and other phytochemicals (Pal, 2017). Proper storage—at ambient temperature and away from direct sunlight—is crucial to preserving these bioactive compounds.

2. MATERIALS AND METHODS

This review synthesises findings from peer-reviewed articles, phytochemical analyses, and ethnobotanical studies on lemon and lime (*Citrus aurantifolia*). Literature was sourced from indexed databases (PubMed, Scopus, Web of Science) using keywords 'Lemon', 'Citrus limon', 'Nutritional value', 'Medicinal uses', and 'Phytochemicals'. Inclusion criteria were studies published between 2000 and 2024 reporting human, animal, or in vitro evidence.

3. RESULTS

3.1 Nutritional Composition

The nutritive value of 100 g unpeeled raw lemon is presented in Table 1.

Nutrient	Amount	Nutrient	Amount
Energy (kcal)	29	Vitamin B6 (mg)	0.080
Carbohydrates (g)	9.32	Vitamin C (mg)	53.0

Fat (g)	0.30	Folate (µg)	11
Dietary fibre (g)	2.8	Calcium (mg)	26
Thiamine (B1, mg)	0.040	Iron (mg)	0.60
Riboflavin (B2, mg)	0.020	Magnesium (mg)	8
Niacin (B3, mg)	0.100	Phosphorus (mg)	16
Pantothenic acid (B5, mg)	0.190	Potassium (mg)	38
		Zinc (mg)	0.06

3.2 Phytochemical Profile

Lemons are cholesterol-free, sodium-free, and nearly fat-free, yet abundant in ascorbic acid, carotenoids, flavonoids, and essential oils. The major phytochemicals include flavonoids (hesperidin, eriocitrin, and diosmin), limonoids (limonin and limonin glucoside), essential oils (limonene, citral, and citronellal), and phenolic acids (ferulic and p-coumaric acids). These compounds collectively contribute to lemon's antioxidant, anti-inflammatory, and lipid-lowering effects.

3.3 Documented Health Benefits

Health Condition	Active Constituents	Mechanism of Action
Scurvy	Vitamin C	Collagen synthesis, antioxidant activity
Skin care	Vitamin C, flavonoids	Antimicrobial, antioxidant, cell renewal
Digestive disorders	Flavonoids, citric acid	Stimulates bile & enzyme secretion
Peptic ulcers	Limonoids, flavonoids	Antioxidant, antimicrobial, mucosal repair
Respiratory disorders	Kaempferol, essential oils	Decongestant, anti-inflammatory
Eye health	Antioxidants	Prevents macular degeneration
Gout	Vitamin C, flavonoids	Reduces uric acid, detoxifies
Gum disease	Vitamin C, potassium	Promotes healing, inhibits bacteria
Hemorrhoids	Fibre, antioxidants	Relieves constipation, heals mucosa
Obesity & weight loss	Pectin, polyphenols	Appetite regulation, lipid metabolism
Hypertension	Eriocitrin, hesperidin, vitamin C	Vasodilation, cholesterol reduction

4. DISCUSSION

The health-promoting properties of lemon arise from the synergistic interaction of vitamins, minerals, and phytochemicals. Vitamin C is a potent antioxidant that enhances immune defense, supports collagen synthesis, and mitigates oxidative damage. Flavonoids such as hesperidin and eriocitrin exert vascular and metabolic benefits, while limonoids exhibit anticancer and hepatoprotective activities. Emerging studies suggest that regular consumption of lemon juice or peel extract can aid in weight management, improve lipid profiles, and protect against oxidative stress-related diseases. Traditional practices, such as consuming lemon water to promote digestion and detoxification, now find partial validation in experimental and clinical studies. However, well-designed clinical trials remain limited and are needed to substantiate dose-response relationships and long-term efficacy.

5. CONCLUSION

Lemon is a nutrient-dense citrus fruit endowed with significant therapeutic potential. Its complex profile of bioactive compounds—particularly vitamin C, flavonoids, and essential oils—confers multiple health benefits related to cardiovascular, digestive, and immune functions. Continued research is necessary to elucidate optimal intake levels, mechanisms of action, and potential synergistic effects with other dietary components.

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