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RESEARCH ARTICLE

CRITICAL REVIEW ON THERAPEUTIC VALUE OF ORANGES (*CITRUS SINENSIS*)

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ABSTRACT

Oranges are rich source of antioxidants including polyphenolic compounds flavonoids, carotenoids, and vitamin C. These antioxidants have anti-inflammatory and anti-cancer properties that help protect cells from damage. Oranges are also high in fiber, folate, and potassium, which can support heart health and prevent neural tube defects in unborn babies. Studies suggest that consuming oranges regularly may benefit your health in several ways, including reducing oxidative damage and inflammation, improving the health of blood vessels, enhancing iron absorption, and supporting a healthy immune response. Drinking fresh orange juice has been found to increase skin carotenoid levels, which are good indicators of total antioxidant status of the body. Orange juice has also been shown to increase antioxidant capacity and decrease TBARS concentration in the blood serum. Hesperidin, a citrus flavonoid that's one of the main antioxidants in oranges, has blood pressure-lowering, anti-inflammatory, and antioxidant effects in the body. In this review antioxidant factors of oranges and their health benefits has been discussed.

INTRODUCTION

Oranges are not only a delicious fruit but also a powerhouse of nutrients and antioxidants. Oranges are packed with phenolic compounds, especially flavonoids, which contribute to most of their antioxidant properties. They are also rich source of vitamin C, fiber, folate, and calcium, among many other beneficial nutrients. Oranges contain various bioactive plant compounds that have anti-inflammatory and antioxidant effects, including flavonoids, carotenoids, and vitamin C. These compounds may reduce inflammation and work against disease. (Adrian A *et al.*, 2008). Oranges originated in Asia, what is now called southeast China (Telon *et al.*, 2020). They were cultivated for at least 7,000 years in India and in China since 2,500 BCE and documented in China since 340 BCE. Sweet orange (*Citrus x sinensis*) is a hybrid between pomelo (*Citrus maxima*) and mandarin (*Citrus reticulata*). Oranges belong to the Rutaceae family, the Citrus genus, which has many species, some 1,600 subspecies, and includes sweet orange, grapefruit, lemons, limes, etc. The first official noting of an orange (fruit) in Europe popped up around the 1300s when it was referred to as orange. The sweet orange was well known throughout Europe by 1646. Oranges were introduced to the Americans by colonists who spread them in the New World.

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Ponce De Leon is alleged to have brought the first orange trees to La Florida, now Florida, in the early 1500s. By 1579, St. Augustine had its first citrus trees. By 1841, William Wolfskill was planting oranges and selling them to gold miners in Los Angeles, California. Today over 140 countries produce citrus fruits — mostly in the Americas, northern and eastern Mediterranean countries, Australia, and South Africa (UN Food and Agriculture, 2021). Citrus fruits are rich in various nutrients, such as vitamins A and C, folic acid and dietary fiber. Furthermore, these fruits are a source of bioactive compounds, being cinnamic acid derivatives, coumarins, and flavonoids the major groups of phenolic compounds (Turner T *et al.*, 2013). Citrus fruit has considerable amounts of flavonoids like, flavones, flavonols, and anthocyanins; however the main flavonoids are flavanones, which the most frequently found are hesperidin, naringin, narirutin and eriocitrin (Benavente-García O and Sun Y 2013). Other phenolics often found in citrus are p -coumaric, ferulic, caffeic and sinapic acids (Sun Y *et al.*, 2013). The daily consumption of grapefruit and orange juice has shown to decrease diastolic blood pressure (Morand C 2005 and Reshef N 2011). Oranges are rich in antioxidants, particularly phenolic compounds and flavonoids, which contribute to most of their antioxidant properties. Hesperidin a citrus flavonoid, is one of the main antioxidants in oranges and have blood pressure-lowering, anti-inflammatory, and antioxidant effects in the body. Antioxidants in oranges help protect cells from damage, reduce inflammation, and work against disease. Oranges may benefit heart health, reduce the risk of chronic diseases, enhance iron absorption, and support a healthy immune response.

Oranges and other antioxidant-rich foods are even more powerful than medication in fighting long-term inflammation, which is a condition with links to cancer, heart disease, diabetes, arthritis, depression, and Alzheimer's. In this review article, health benefits of orange has been discussed.

Major bioactive compounds in orange and there health benefits

Flavonoids: Flavonoids have a 15-carbon skeleton (C6-C3-C6) and two six-carbon phenyl rings connected by a heterocyclic ring with an inserted oxygen. The subgroups of flavonoids include flavones, flavonols, flavanones, flavanonols, flavanols (flavan-3-ols), isoflavones, and anthocyanins (Peng *et al.*, 2021; Zhang *et al.*, 2019).

Flavonoids occupied 89.34% of polyphenolic fractions, dominated by flavanoneseriocitrin and hesperidin as significant components, which accounted for 52.81% and 31.31% of the total flavonoids, respectively (Smeriglio *et al.*, 2019)

Carotenoids and Apocarotenoids: The carotenoids can be categorized into two major groups: firstly carotenes—the hydrocarbon carotenoids, such as α - and β -carotene, and lycopene; secondly xanthophylls—oxygenated derivatives of hydrocarbon carotenoids, such as neoxanthin, violaxanthin, lutein, and β -cryptoxanthin (Saini *et al.*, 2015). The presence of carotenoids and apocarotenoids confers the orange-red color to the peel and pulp of orange (Luan *et al.*, 2019)

Terpenes and Limonoids: Due to the presence of terpenes and limonoids along with other bioactive components including flavonoids, carotenoids, and coumarins, the essential oil derived mostly from the flavedo of citrus fruits is an economically significant product with positive health effects (Raspo *et al.*, 2020). Citrus essential oils have strong antibacterial, analgesic, anxiolytic, and antioxidant properties (Gonzalez-Mas *et al.*, 2019).

Traditional uses: *C. sinensis* is consumed all over the world as an excellent source of vitamin C, which is a powerful natural antioxidant that builds the body's immune system (Etabu.E *et al.*, 2014). Constipation, cramps, colic, diarrhoea, bronchitis, tuberculosis, cough, cold, obesity, menstruation disorders, angina, hypertension, anxiety, depression, and stress are among the conditions it has historically been used to treat (Milind *et al.*, 2012).

Table 1. Nutrient content in 100g of orange pulp

NUTRIENTS	AMOUNT (100g)
Energy	156kcal
Protein	0.70g
Total lipid	0.13g
Ash	0.36g
Carbohydrate	7.92g
Fiber	1.29g
MINERALS	
Iron	0.81mg
Calcium	19.5mg
Magnesium	11.5mg
Potassium	164mg
Sodium	6.68mg
Zinc	0.04mg
Copper	0.03mg
Manganese	0.029mg

Source:- IFCT, 2017.

Benefits of orange in different kind of diseases:

Cancer: Vitamin C, which aids in preventing cancer, is abundant in oranges. Studies have shown an inverse correlation between vitamin C and some malignancies, including oesophageal, oral, and stomach cancer. This makes sense because vitamin C protects against the cancer-causing nitrosamines found in food that are thought to be responsible for stomach, colon, and mouth cancers. (Chao Yang *et al.*, 2017).

Citrus peel alcohol has the power to cause tumour cells to undergo apoptosis without causing any damage to healthy cells and has the ability to transform tumour cells back into differentiated cells. According to studies, oranges can enhance the immune system and safeguard the body by acting as antioxidants, which prevent tumour formation. The angiogenesis, metastasis, and cell death of human colon cancer cells have all been shown to be inhibited by blood orange essential oil. The immune-modulatory and antioxidant properties of orange peel extract may be the cause of its ability to prevent or protect against cancer (Chao Yang *et al.*, 2017).

Cardio-vascular diseases: Orange has long been utilised extensively for the treatment and prevention of CVDs. Many studies have demonstrated that consuming orange juice can reduce the risk of CVDs caused by conditions including hyperglycemia, oxidative or inflammatory stress, dyslipidemia, hypertension, endothelial dysfunction, and obesity (Aptekam NP *et a.*, 2013). In a recent study it was reported orange juice inhibited the activity of the enzymes monoamine oxidase (MAO), phosphodiesterase (PDE), and angiotensin-converting enzyme (ACE) in the rat heart (Ademosun *et al.*, 2017). Malondialdehyde produced by Fe²⁺ was likewise decreased by orange juice in a concentration-dependent manner. The resultsshowed that an orange treatment plan was possible. To stop and manage CVDs by blocking the enzymesand avoiding oxidative harm (Ademosun *et al.*, 2017). It has been reported that consuming one orange juice every day could reduce healthy men's risk of stroke by 25%, whilst other fruits only reduce risk by 2%. Greater than 350 to 400 mg per day supplementing with vitamin C for at least ten years appears to be a successful strategy for reducing the danger of having cataracts form (Jyotsna *et al.*, 2011).

Liverdiseases: Oranges and citrus fruits, in general, contain powerful antioxidants that may help protect liver cells and ease inflammation that can lead to liver disease (Yang Xia *et al.*, 2019). Studies suggest that flavonoids in oranges act as antioxidants and improve liver steatosis, and hesperidin, a orange flavonoid, decreases pro-oxidant enzymes and increases antioxidant hepatic enzymes, which can help improve the antioxidant status and decrease oxidative stress in patients with chronic hepatitis C treated by pegylated interferon alfa and ribavirin. However, a study found that orange intake may be a double-edged sword in the development of non-alcoholic fatty liver disease (NAFLD) due to the high fructose content in oranges, which is a risk factor in the progress of NAFLD (Meiyi Hu *et al.*, 2021)

Obesity and metabolic dysfunction: In obese mice, intervention with either of the citrus flavonoids, naringenin or nobiletin, added to a high-fat diet reverses weight gain. Without reducing food intake, management with chow can reduce weight gain and obesity.

Naringenin or nobiletin-treated mice consume more calories but also burn more energy without engaging in more ambulatory exercise. Mice treated with flavonoids regain insulin sensitivity and fully reverse hyperinsulinemia. Hepatic fatty acid oxidation is increased while plasma lipids are reduced, resulting in reduced hepatic lipids. Together, these reductions in atherogenic risk variables did not cause a contraction of the lesion but rather improved lesion morphology, most notably a decrease in the lesion's macrophage content, which is consistent with the beginning phases of atherosclerosis regression. These studies emphasise the therapeutic potential of either naringenin or nobiletin, particularly in the setting of current obesity (Burke *et al.*, 2018).

Osteoporosis:-In one of the studies done by Shalaby *et al.*, 2011 on ovariectomized rats, the administration of ethanol extract of *C. sinensis* leaves and peel (5 mg/kg) boosted trabecular bone mineral content and bone mineral density of the tibia as well as improved levels of phosphorus and calcium, reducing bone loss and another study done by Favela-Hernandez have concluded the same result. (Shalaby *et al.*, 2011) (Favela-Hernández *et al.*, 2016)

CONCLUSION

Oranges are a great source of antioxidants, including phenolic compounds, flavonoids, carotenoids, and vitamin C. Studies suggest that consuming oranges regularly benefit health in several ways, including reducing oxidative damage and inflammation, improving the health of blood vessels, enhancing iron absorption, and supporting a healthy immune system including being good for the heart, digestive health, lowering cholesterol risk for heart disease, and preventing ulcers. They help you lose weight and boost your immunity. Orange juice has anti-inflammatory properties and help treat chronic diseases. Drinking fresh orange juice has been found to increase skin carotenoid levels, which are good indicators of total antioxidant status of the body. According to a study (Ao *et al.*, 2021) the findings from the histopathology of the chosen organs demonstrated that there was no tissue deterioration and that the organs were pathologically healthy, supporting the preventative and therapeutic benefits of drinking fresh orange juice.

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