**COMPARATIVE ANTIOXIDATIVE ANALYSIS OF LEMON PEEL AND ORANGE PEEL- A REVIEW**

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Abstract

In the present study nutrient composition and importance of lemon peel and orange peel were investigated. Lemon peels really contain beneficial nutrients like vitamin C, pectin, calcium, potassium, fibre, alpha hydroxy acids, and flavonoids like D-limonene are all abundant in lemon peels. Lemon peel contains bioactive chemicals, which have been linked to a number of health advantages, according to studies.Orange (*Citrus auranthium*) flesh peel (OP) was extracted with acetone, ethanol, and methanol were tested for their antioxidant activity. It was reported that two C-glucosyl flavones with antioxidant properties were found in the peel of lemons as identified by using UV, IR, FAB-MS, 1H NMR, and 13C NMR investigations, they were recognised as 6,8-di-C-glucosyldiosmin (LE-B) and 6-C-glucosyldiosmin (LE-C), respectively. Using the linoleic acid autoxidation, the liposome oxidation system, and the low-density lipoprotein (LDL) oxidation system, the antioxidative actions of LE-B, LE-C, and flavonoid components (eriocitrin, diosmin, hesperidin, and narirutin) in lemon fruit were investigated. In these autoxidation systems, LE-B and LE-C demonstrated antioxidative action, but they did so at a lower level than eriocitrin, its eriodictyol, or its aglycon. In the LDL oxidation system, eriocitrin and its metabolites by intestinal bacteria (eriodictyol, 3,4-dihydroxyhydrocinnamic acid, and phloroglucinol) demonstrated antioxidative activity that was higher than that of -tocopherol and somewhat equal to that of epigallocatechin gallate.

**Introduction**

Oranges are tangy, sweet citrus fruits that are renowned for having a lot of vitamin C. Perhaps less widely known is the fact that orange peels are a good source of fibre, vitamin C, and plant chemicals like polyphenols. In fact, 1 tablespoon (6 grammes) of orange peel supplies 14% of the Daily Value (DV) of vitamin C, which is approximately three times as much as the interior fruit. According to studies, diets high in fiber and vitamin C are good for the heart and digestive systems as well as possibly preventing some cancers. Additionally, orange peel has significant amounts of calcium, provitamin A, folate, riboflavin, thiamine, vitamin B6, and folate. Nuritional Composition of lemon peel & orange peel: The orange peels include calcium, fibre, vitamin C, folate, and vitamin B6 in good amounts. Orange peel has a lot of polyphenols, which protect against a number of diseases. Peels contain anti-cancerous properties because of limonene, a naturally occurring molecule. Total phenolic content (TPC), 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity (RSA), total radical-trapping anti-oxidant potential (TRAP), oxygen radical absorbance capacity (ORAC), and cellular antioxidant activity (CAA) were used to measure antioxidant potential. Orange peels mostly consist of cellulose, followed by lignin and hemicellulose in terms of chemical makeup. As the easiest natural polymer to break down into its monomers, cellulose facilitates fermentation. The nutrients are more concentrated in lemon peels are Vitamin C, pectin, calcium, potassium, fibre, alpha hydroxy acids, and flavonoids like D-limonene are all abundant in lemon peels. Lemon peel contains bioactive chemicals, which have been linked to a number of health advantages, according to studies.

**Table-1**: Nutrient content in Orange Peel (Oboh *et al.,*2012)

|  |  |
| --- | --- |
| **Nutrients** | **Amount (%)** |
| Potassium  Calcium  Phosphorus  Magnesium  Moisture content  Solubility  Ashes  Carbohydrates  Sugars  Fibre  Protein  Lipids  Vitamin C  Energetic value/100g | 0.181  0.040  0.014  0.010  76.74%  8-13%  0.44%  11.75%  9.35%  2.4%  0.94%  0.12%  0.0532%  47kcal |

**Table-2**: Nutrient content in Lemon Peel (Oboh *et al.,*2012)

|  |  |
| --- | --- |
| Nutrients | (%) |
| Protein  Thiamin (vit. B1)  Riboflavin (vit. B2)  Niacin(vit. B3)  Pantothenic acid (B5)  Vitamin B6  Folate (Vit C. B9)  Choline  Vitamin C  Calcium  Iron  Magnesium  Manganese  Phosphorus  Potasium  Zinc | 1.1  3  2  1  4  3  3  5.1  53  26  0.6  8  0.03  16  1.38  0.06 |

**Health Benefits of Orange Peel & Lemon Peel**

Antibacterial compounds found in lemon peel may prevent the growth of micro-organisms. Researchers found four chemicals in lemon peel in one study that had potent antibacterial activities and successfully combat germs that cause common mouth diseases organisms.D-limonene and vitamin C are two of the many antioxidants found in lemon peel. Consumption of flavonoid antioxidants, such as D-limonene, is associated with a lower risk of developing several diseases, including type 2 diabetes and heart disease.Numerous antimicrobial and antifungal properties of lemon peel have been reported. Notably, this peel significantly harmed and inhibited the growth of bacteria resistant to antibiotics in a test-tube study. By promoting the elimination of bile acids, which are made by your liver and bind to cholesterol, lemon peel pectin may also lower cholesterol levels.

Studies show that a protein linked to cancer is inhibited by the flavonoids in orange peels. The peels also contain limonene, a substance that lowers the chance of developing cancer.

Vitamins C and A are abundant in orange peels. Because of this, orange peels act as a natural antioxidant that strengthens your body's defences against disease and viruses. Orange peels' vitamin C content aids in lung cleansing and the dissolution of congestion. Additionally enhancing immunity, vitamin C aids in fighting off and preventing lung infections. Hesperidin and polymethoxyflavones (PMFs), two polyphenols that are being investigated for their possible anticancer properties, are abundant in orange peels. The present study aims to investigate comparative nutritional analysis of orange peel and lemon peel with reference to antioxidative property of both the peels. The present author also noted the the application of both the peels in food sectors and biomedical fields.

**Discussion**

The orange peels are a good source of calcium, fibre, vitamin C, folate, and vitamin B6. Oranges' skin is rich in polyphenols, which defend against a variety of ailments. Due to the presence of limonene, a naturally occurring chemical, peels have anti-cancerous qualities. Additionally, the peel's essential oil has anti-inflammatory properties that strengthen your immune system. Studies show, that a protein linked to cancer is inhibited by the flavonoids in orange peels. The peels also contain limonene, a substance that lowers the chance of developing cancer. Pectin, a fibre with a reputation for regulating blood sugar levels, is abundant in orange peels. Diabetes sufferers undoubtedly benefit from this. Orange peel extract therapy has also been proven in studies to be effective in treating diabetic nephropathy . Several studies shown that orange peel exhibits excellent anti-inflammatory. Several researches have shown that orange peel contains flavonoids associated with antioxidant activity . The glycosides hesperidin and naringin are mainly responsible for the purported antioxidant activity of orange peel extract. Several studies have also shown that antioxidants present in orange peel protects body from oxidation caused by free radicals, which are unstable molecules within the body. The hesperidin, polymethoxyflavones (PMFs), and other plant compounds concentrated in the peel have anti-swelling and antioxidant properties that can help support your immune system.

Lemon peels are packed with vitamin C, pectin, calcium, potassium, fiber, alpha hydroxy acids, and flavonoids such as D-limonene. Studies have shown that lemon peel contains bioactive compounds that have several health benefits. In one study, researchers identified four compounds in lemon peel that have powerful antibacterial properties and effectively fight common oral-disease-causing bacteria. Lemon peel is high in antioxidants, including D-limonene and vitamin C. Intake of flavonoid antioxidants like D-limonene is linked to a reduced risk of certain conditions, such as heart disease and type 2 diabetes. Numerous antimicrobial and antifungal properties of lemon peel have been studied.This peel severely harmed and inhibited the growth of antibiotic-resistant bacteria in a test-tube investigation. Several researches have said that By promoting the elimination of bile acids, which are made by liver and bind to cholesterol, pectin in lemon peels may also help lower cholesterol levels. Several studies have shown that, lemon peels have a high amount of citrus bioflavonoids, which is a very powerful agent for reducing Oxidative stress from the body.Lemon peels are rich in antioxidants which detoxify skin in a great extent and fight with several skin problems.

**Conclusion**

Orange peel and lemon peel are generally used as waste products. Literature demonstrates that when compared to pulp and seeds, peel extracts exhibited the highest antioxidant activity. These peels can be used in pharmaceuticals, cosmetics and different dietary prtoducts. We wish its proper use in near future in food, pharmaceutical and biomedical industries.

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