

Antimicrobial and antioxidant properties of peel and seed extract of *Carica papaya* L.

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Received 27 August 2023; Revised 20 February 2024

Carica papaya is a widely consumed fruit in many tropical areas of the world, but its peel and seeds are generally discarded as waste material. However, peels and seeds consist of various natural bioactive compounds that are responsible for many medicinal and therapeutic properties and can be further used in various industries for functional foods, pharmaceuticals, and cosmetic products. Since ancient times, the entire plant of *Carica papaya* L., including the peel, seeds, leaves, etc., has been used as traditional medicine. Here, we studied the phytochemical constituents, antimicrobial and antioxidant activities of papaya waste (peel and seeds) samples obtained from the local market in Jammu district of Jammu & Kashmir. Antimicrobial assessment using the agar-well diffusion method revealed the substantial efficacy of both the extracts. At a concentration of 100 $\mu\text{g/mL}$, both papaya peel and seed ethanolic extracts exhibited substantial zones of inhibition against *Escherichia coli* (16.00 \pm 1.00 mm and 19.40 \pm 1.15 mm), *Bacillus cereus* (21.50 \pm 1.00 mm and 08.00 \pm 1.00 mm), *Klebsiella pneumoniae* (25.50 \pm 1.00 mm and 20.00 \pm 1.00 mm) and *Staphylococcus aureus* (14.40 \pm 1.15 mm and 7.50 \pm 1.00 mm), respectively. The minimum inhibitory concentration (MIC) was determined using the macro broth dilution method, indicating that the seed extract had a maximum MIC of 100 $\mu\text{g/mL}$ against all test pathogens, surpassing the peel extract. The qualitative analysis showed that phytochemicals including tannins, saponins, alkaloids and phytosteroids were absent in both the extracts. The bioactive potential of papaya peel and seeds is quantified by determining their total phenol content and total flavonoid content. The papaya seeds exhibited TPC of 62.45 mg GAE's/gdw and a TFC of 47.84 mg QE's/gdw, followed by papaya seeds. The peel extract demonstrated significant antioxidant potential, exhibiting remarkable DPPH radical scavenging activity (IC_{50} value: 55.50 $\mu\text{g/mL}$) and β -carotene/linoleic acid assay (IC_{50} value: 75.80 $\mu\text{g/mL}$), surpassing the seed extract. This study concludes that papaya waste can be a good source of antimicrobial and antioxidant agents.

Keywords: Antimicrobial, Antioxidant, Functional foods, Nutraceutical, Papaya waste