

PHYTOCHEMICAL COMPOSITION AND BIOACTIVE POTENTIAL OF *Zanthoxylum nitidum*, *Piper nigrum*, AND *Cinnamomum tamala*

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This study provides a comprehensive evaluation of the phytochemical composition and bioactivities of ethanol extracts of Zanthoxylum nitidum, Piper nigrum, and Cinnamomum tamala, focusing on their antioxidant, enzyme inhibitory, and anti-inflammatory properties. The total phenolic, flavonoid, and alkaloid contents of each extract were quantified, and multiple bioassays were employed to assess their therapeutic potential. Antioxidant activities were analyzed using three distinct assays: DPPH, ABTS, and total antioxidant capacity. Piper nigrum showed the strongest DPPH free radical scavenging activity ($IC_{50} = 98.38 \pm 1.97 \mu\text{g/mL}$), while Cinnamomum tamala excelled in the ABTS radical scavenging assay ($IC_{50} = 634.25 \pm 12.68 \mu\text{g/mL}$). Zanthoxylum nitidum exhibited the highest TAC, correlating with its phenolic content. The enzyme inhibitory assays revealed C. tamala as the most potent α -amylase inhibitor, while P. nigrum was the strongest α -glucosidase inhibitor, establishing their potential for glycemic control. Anti-inflammatory activity was also significant, with P. nigrum showing the highest inhibition of protein denaturation. Although strong trends were observed between bioactivities and phytochemical contents, many correlations were not statistically significant, indicating the need for larger sample sizes in future studies. These findings highlight the therapeutic potential of these plants, particularly for managing oxidative stress, diabetes, and inflammation. Further research may explore bioactive constituents and their mechanisms of action to deepen the understanding of the therapeutic properties of these plants.
