

Abstract

Sesame (*Sesamum indicum* L.) is a widely cultivated oilseed crop used as a culinary staple and for its antioxidant properties. However, much focus is on the seeds, with the remaining parts being discarded or underutilized. This study aimed to investigate the presence, composition, and bioactive potential of phytoconstituents in non-seed parts of sesame plants, namely, the leaves, stems, and fruits (pods) across several Taiwanese black sesame varieties. To accomplish this, plant extraction was done using UAE, then analyzed through TLC and HPTLC for preliminary phytoconstituent profiling. LC-MS/MS-based molecular networking was performed to characterize compound classes, followed by chemical assays such as TPC, TFC, DPPH, and ABTS, including IC₅₀ determinations. This study found that non-seed parts contained phenylethanoid glycosides, flavonoid glycosides, triterpenoids, and lignans. Chemical assays indicated that the seeds generally exhibited the highest phenolic levels, followed by the leaves and fruits (pods), although the leaves showed higher flavonoid abundance. The CY2 leaf and fruit (pod) extracts demonstrated notable radical-scavenging activity, with potency comparable to or greater than that of plant extracts in external studies. Two-way ANOVA analysis indicated that plant parts significantly influenced antioxidant activity, TPC, and TFC, while the effects of regional variety were more dependent on plant parts. Differences in antioxidant activity, phenolic content, and flavonoid content may be attributed to the physiological roles of each plant part. This study highlights the potential of non-seed sesame parts as valuable sources of phytoconstituents with measurable antioxidant activity, promoting a more sustainable use of sesame crops.

Keywords: *Sesamin Indicum* L., Phytochemistry, Analytical Chemistry, HPTLC, Molecular Network