Enhancing Public Awareness of the Anti-Diabetic Potential of Mangrove Plants: Comparative Antioxidant Potential of Different Parts of *Avicennia marina* and their Role in Preventing Insulin Protein Aggregation

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Pancreatic β-cells are highly susceptible to oxidative stress due to their limited antioxidant defense. Excessive reactive oxygen species production in β-cells induces insulin protein aggregation, enhancing the progression of diabetes. Recently, plant antioxidants have gained attention as potential anti-diabetic therapeutics. *A. marina*, a mangrove plant rich in bioactive phytochemicals, is known for its antioxidant properties. However, comparative evaluation of antioxidant capacities in different plant parts and their protective effects against insulin aggregation remain unknown. This study aimed to determine the anti-diabetic potential of *A. marina* by comparing *the* antioxidant capacities of root, leaf, flower, and stem extracts and investigating the protective effects against oxidative stress–induced insulin protein aggregation. Plant parts of *A. marina* were collected, air-dried, powdered, and methanol extracts were made. Antioxidant activity was determined using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay, while inhibition of oxidative stress (H_2O_2) induced insulin aggregation was evaluated using an *in vitro* spectroscopic assay by monitoring absorbance changes at 460nm. Leaf extracts showed the highest extraction yield (40%), whereas stem, root, and flower extracts exhibited lower yields (20%). DPPH assay demonstrated variable antioxidant capacities among plant parts, with stem extract showing the highest (71.70±0.28%), followed by root (55.88±3.30%), flower (32.45±3.56%), and leaf extracts (26.76±3.25%). Insulin aggregation analysis revealed that stem extract exerted the strongest anti-aggregation effect, reducing aggregated protein levels to 20.75±3.23%, relative to the aggregated control (100%). Root, leaf, and flower extracts reduced aggregation to 78.23±8.06%, 69.89±8.17%, and 89.25±1.29%, respectively. The strong antioxidant profile of stem extracts paralleled their enhanced ability to suppress insulin aggregation, suggesting a relationship between antioxidant capacities and prevention of oxidative protein aggregation. Overall, findings indicate that *A. marina* possesses promising anti-diabetic potential, highlighting its therapeutic value.

Keywords: *Avicennia marina, Antioxidant, Insulin protein aggregation, Diabetic potential, Leaf extracts*