A Colorimetric Lateral Flow Assay to Detect Neurodegeneration From Tears, Phase I

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Neurodegenerative disorders like Alzheimer’s disease affect approximately 55 million people worldwide and are expected to double every 20 years. Standard detection methods, such as cerebrospinal fluid collection and neuroimaging techniques, often require specialized facilities and painful procedures, which can be costly, making early detection and treatment inaccessible to many. This research aims to address these limitations by developing a colorimetric lateral flow assay to detect tau proteins in tears. Tau proteins, which are involved in the pathology of diseases like Alzheimer's, serve as crucial biomarkers for neurodegeneration. To identify the presence of these proteins, molecularly imprinted polymers (MIPs) were synthesized via bulk polymerization instead of antibodies. The synthesis process involved precise template protein, functional monomer, and crosslinker reactions in a 1:4:20 experimental ratio, followed by UV polymerization and template removal. These MIPs were then incorporated into nitrocellulose membranes to create lateral flow strips designed to detect protein concentrations in the nanomolar range through a bicinchoninic acid (BCA) colorimetric reaction analyzed using ImageJ. This approach overcomes the limitations of antibody-based systems by providing increased stability and comparable specificity, allowing this assay to serve as a preliminary screening technique. Additionally, this assay is 96% more cost-effective than amyloid PET scans, does not require trained technicians or advanced facilities, and is non-invasive, making it a potentially practical alternative for millions of dementia patients in rural and underserved communities.

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