



From Saliva to Systems Biology: A Multiomics Framework for Early Alzheimer's Disease Biomarkers



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BACKGROUND

The development of accessible, non-invasive biomarkers is a critical priority in Alzheimer's disease (AD) research, particularly for early detection and population-level screening. While cerebrospinal fluid and blood biomarkers have advanced diagnostic accuracy, their use remains limited in large-scale, low-resource, or longitudinal contexts. Saliva has emerged as a promising biological matrix, reflecting neurodegenerative, inflammatory, metabolic, and stress-related processes relevant to AD pathophysiology. Integrating salivary biomarkers into a multi-omics framework offers an opportunity to bridge molecular alterations with systems-level dysfunction, enabling earlier identification of individuals at risk and a more holistic understanding of disease mechanisms.

METHODS

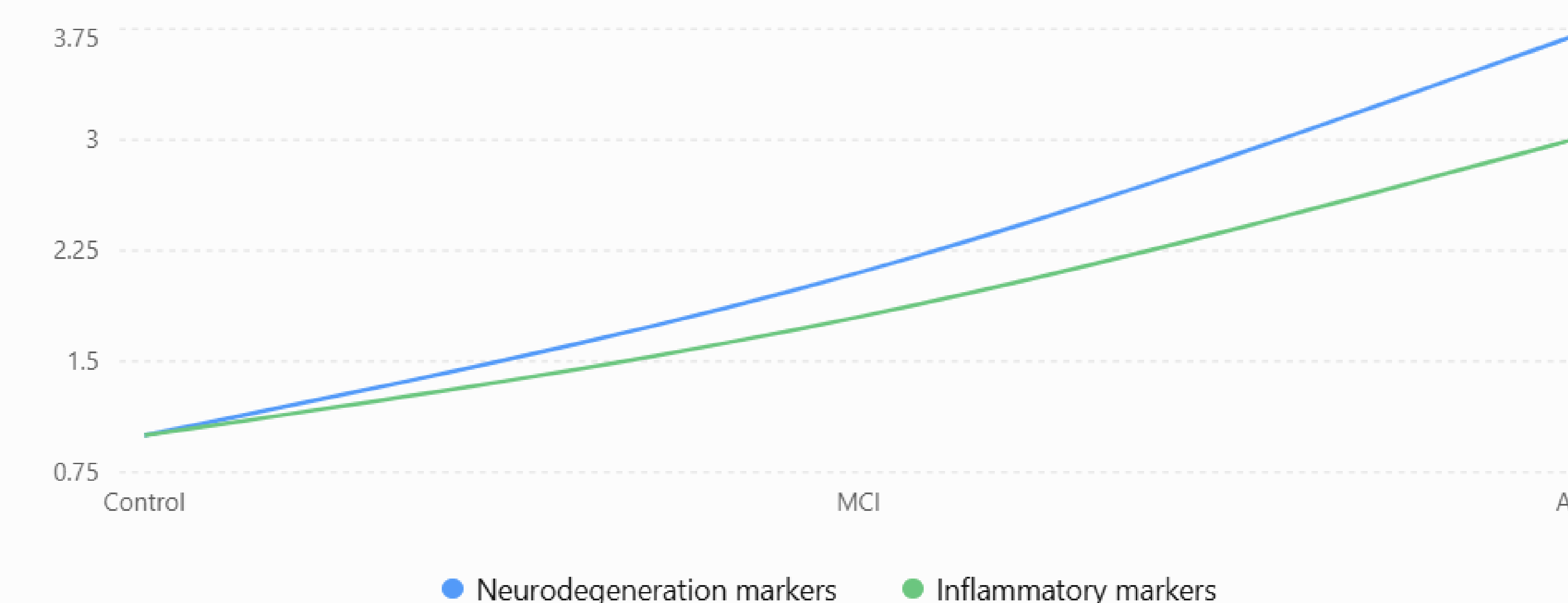
An observational study was conducted including cognitively intact controls, individuals with mild cognitive impairment, and patients with a clinical diagnosis of Alzheimer's disease. Standardized saliva collection protocols were applied, followed by quantification, via immunoassay, of selected biomarkers of neurodegeneration and inflammation. Clinical, cognitive, and neuropsychiatric assessments were performed in parallel. The data were integrated using a multiomics and systems biology approach to explore network-level associations and pathway interactions relevant to the early processes of Alzheimer's disease.

Results

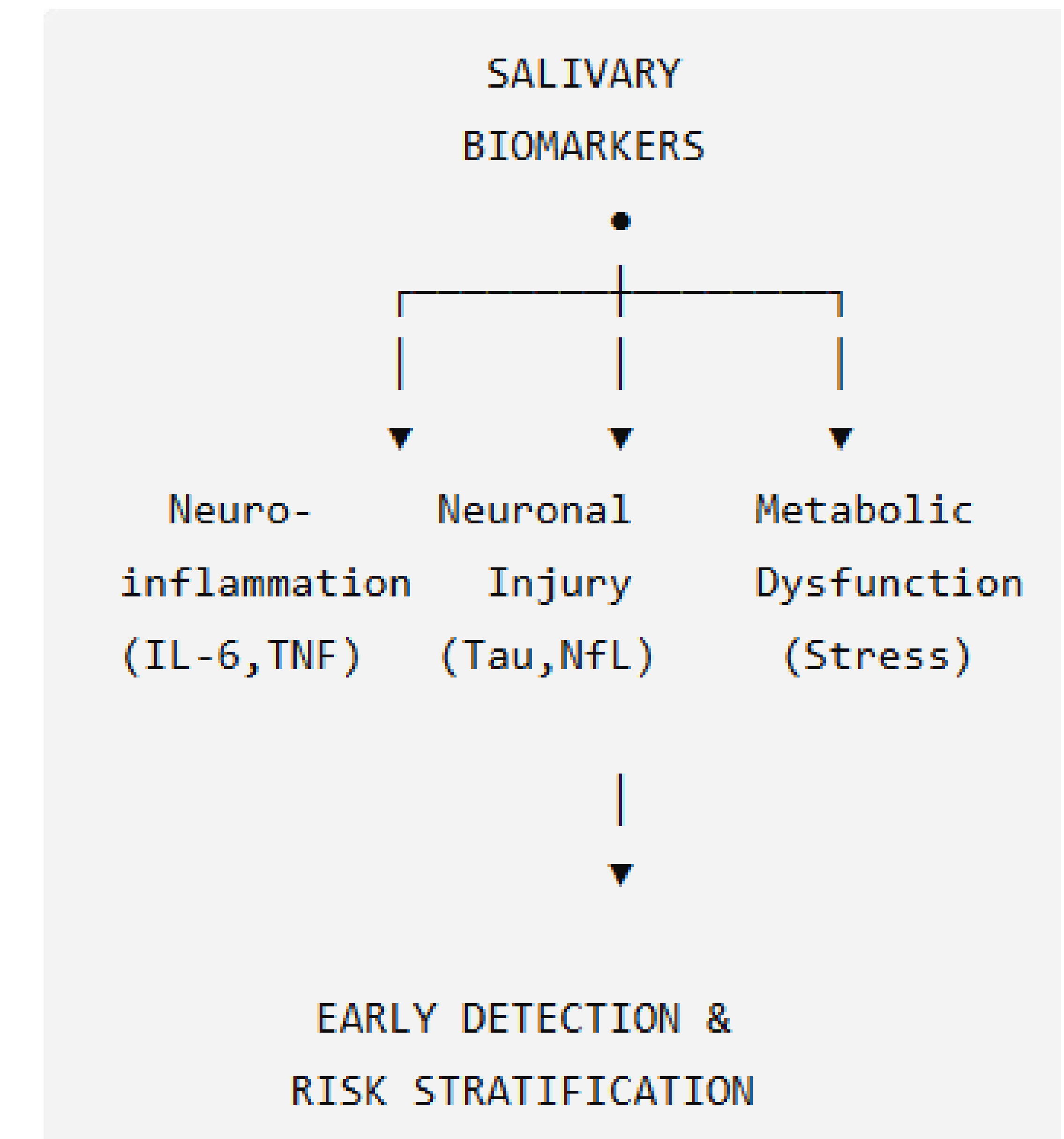
Distinct patterns of salivary biomarkers were observed across the cognitive spectrum, with progressive alterations in markers related to neuronal injury and inflammation. Multiomic integration revealed coordinated dysregulation of pathways involved in neuroinflammation, synaptic function, and metabolic homeostasis. Salivary profiles were associated with specific cognitive domains, reinforcing their relevance beyond overall cognitive status. Systems-level analyses highlighted potential biomarker networks capable of discriminating individuals in early stages of cognitive impairment from cognitively intact controls, suggesting utility for risk stratification and early detection.

Progressive Alterations in Salivary Biomarkers Across the Alzheimer's Continuum

Conceptual representation of coordinated changes in salivary biomarkers from cognitively normal individuals to Alzheimer's disease.



The authors declare that there is no conflict of interest related to this presentation.



Saliva-Based Multiomics Framework for Early Alzheimer's Disease Detection

Figure. Simplified conceptual framework illustrating how salivary biomarkers reflecting neuroinflammation, neuronal injury, and metabolic dysfunction may contribute to early detection and risk stratification in Alzheimer's disease.

Conclusion

This multiomics framework demonstrates the viability and translational potential of saliva-based biomarkers, integrated within a systems biology perspective for the early diagnosis of Alzheimer's disease.