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SALIVA METABOLOMICS AS AN EMERGING TOOL FOR ADVANCED DIAGNOSTICS: THE LEUKOPLAKIA PARADIGM

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Saliva is a complex fluid produced by salivary glands and serves as a valuable source of information for both oral health and systemic conditions. Its non-invasive collection method has led to numerous studies aimed at identifying specific biomarkers linked to both pathological and physiological changes. While genomic and proteomic analyses of saliva have been employed for the early detection of oral diseases, metabolomic analysis is a more recent focus. It provides an overview of an organism's functional state, making it a powerful tool for biomarker identification and the discovery of new therapeutic targets.

Leukoplakia is characterized by white patches on the inner surfaces of the oral cavity and has the potential to progress to oral squamous cell carcinoma (OSCC), underscoring the need for effective screening and early diagnostic procedures. In our pilot study, we employed salivary metabolomics to derive potential biomarkers for leukoplakia, both with and without dysplasia, and compared the resulting profiles with preliminary data from patients diagnosed with OSCC.

Unstimulated saliva was collected from 26 patients with oral leukoplakia (13 with dysplasia and 13 without), 13 patients with OSCC, and 12 healthy subjects. ^{1}H-NMR spectroscopy enabled the identification and quantification of 72 salivary metabolites. Univariate and multivariate statistical methods were applied to evaluate metabolite concentration profiles. The salivary metabolite profiles of patients with leukoplakia, both with and without dysplasia, showed distinct alterations compared to those of healthy subjects. These metabolic changes were particularly pronounced in cases of dysplastic lesions. Multivariate ROC curve analysis of selected metabolites revealed that the model with the highest diagnostic accuracy effectively distinguished between dysplastic leukoplakia and healthy cases. Additionally, leukoplakia-associated metabolic patterns were evaluated against preliminary data from patients with OSCC.

Our metabolomic approach, based on salivary profiling, revealed promising non-invasive biomarkers for the clinical diagnosis of leukoplakia. With validation in larger cohorts, these tools may enhance clinical monitoring and support precision diagnostics aimed at counteracting disease progression.

References

1. Ferrari, E., et al. (2025) "Salivary metabolomics discloses metabolite signatures of oral leukoplakia with and without dysplasia", International Journal of Molecular Sciences, 26(13), 6519. doi:10.3390/ijms26136519.