

Advancing Precision Nutrition in T2D Patients: The Role of Patient Clustering

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Background: Type 2 diabetes (T2D), a preventable pandemic, can be managed with lifestyle changes, including diet. However, accurately predicting postprandial (post meal) blood glucose is crucial to improve T2D management.

Methods: We performed unsupervised clustering to identify patient subgroups based on similar biological and lifestyle characteristics among 89 adult T2D patients. Next, we compared the performance of machine-learning models to predict postprandial glucose—specifically, cluster-based vs. benchmark, aggregate models using continuous glucose monitors, and over ~11 days.

Results: Patient clustering improved the predictability of postprandial glucose levels, with accuracy increasing from $61\pm 11\%$ to $68\pm 9\%$, compared to the aggregated model. Daily nutrition choices (food groups and quantity) explained the highest feature importance relative to baseline and temporal characteristics. However, we observed substantial heterogeneity in nutrition importance, ranging from 52.4% to 77.3% among patient clusters.

Conclusion: These findings show the potential of patient clustering to improve postprandial glucose prediction and inform precision nutrition support in T2D management. This research sets the stage for integration with lifestyle features and consumer wearable technologies, to improve prediction accuracy.

Self-declaration category: X Clinical

Status of first student: X student