High-Speed Analysis of Branched Chain Amino Acids Using Online Microdialysis - Capillary Electrophoresis

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Gold statement

- Learn about high-speed capillary electrophoresis and its integration with microdialysis sampling
- Gain insight into the role BCAA's play in energy regulation
- Discover potential effects of artificial sweeteners on energy regulation.

Introduction

Obesity rates continue to rise at an alarming rate. This is particularly troubling since obesity has been shown to be a contributing factor, if not outright cause, of many of the most significant health disorders facing society today including heart disease, cancer, stroke, diabetes, arthritis, and depression. While the overall scope of the epidemic is well known, surprisingly little is known about how the body regulates energy, especially in response to external stimuli or food ingredients. Adipose tissue has been increasingly recognized as an endocrine organ that plays a central role in systemic energy regulation. Our group has been developing high-speed, microfluidic assays for adipocyte chemical messengers to help gain mechanistic insight into this regulation.

Body

We have developed high-speed microdialysis-capillary electrophoresis (MD-CE) assays for branched chain amino acids (BCAAs). Microdialysis is the most commonly applied method for sampling changing concentrations of small molecule analytes in tissues. The ability to sample from living systems over long time periods without needing to remove fluid aliquots has led to the widespread adoption of microdialysis in the neuroscience and pharmacokinetics fields. When coupled with online labeling and high-speed capillary electrophoresis variations in analyte concentrations can be measured every 10-20 seconds. BCAA's are necessary precursors for the TCA cycle and their uptake by adipocytes is a signal for lipogenesis. Circulating BCAA's are a strong systemic growth signal that is regulated by adipocyte uptake. Our MD-CE assays for BCAA's are able to detect low nM concentrations of BCAA's with <20 s temporal resolution. We have used these assays to monitor BCAA uptake in response to natural and artificial sweeteners in in vitro and in vivo models.

Conclusion

The high-speed microfluidic assays described here will allow the acute effect of food additives or other stimuli on adipocyte regulation of energy balance, appetite and inflammation to be measured for the first time. These assays will provide valuable information for both assessing the safety of the food supply as well as achieving a better understanding of how adipose tissue regulates these important functions. Together these data may provide key insights into the origins of metabolic disorders and suggest strategies for breaking the cycle of rising obesity levels that is quickly becoming a worldwide epidemic.