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Abstract

Postprandial Composite Biomarkers of Low-Grade Inflammation to Evaluate Nutritional Intervention Effects †

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Abstract: Background and objectives: Low-grade inflammation, a hallmark of metabolic disorders, originates in tissues as a consequence of metabolic dysfunction before it progresses to systemic manifestation. The early detection of low-grade inflammation in blood, therefore, is difficult. Here, we set out to develop a postprandial composite biomarker as an early indicator of low-grade inflammation to evaluate the effects of nutritional interventions. Methods: A postprandial composite biomarker was constructed with elastic net regression based on four blood cytokine responses to a mixed-meal challenge test in human reference groups ('healthy': 20–29 years, BMI < 25 kg/m^2; 'compromised': 50–59 years, BMI > 25 kg/m^2). The biomarker response was evaluated in three RCT studies with overweight adults and included two studies focusing on energy restriction (ER) and a whole-grain wheat intervention. In one ER study, an extended postprandial composite biomarker was constructed based on a total of twelve inflammatory and vascular markers. Results: A postprandial composite biomarker based on four blood cytokine responses to the mixed-meal challenge test could discriminate between the 'healthy' and 'compromised' reference groups. The whole-grain wheat intervention showed a significant reduction in the postprandial composite biomarker. No effects of caloric restriction, irrespective of quality of the diet, were observed on the biomarker. The extended postprandial composite biomarker reduced significantly in the persons within the 20% ER intervention group and did not change in the persons in the weight maintenance arm. The reduction correlated with body fat distribution, in particular, the ratio between subcutaneous and internal fat depots. Discussion: Composite biomarkers based on postprandial blood-based cytokine levels are well capable of discriminating low-grade inflammation between 'compromised' and 'healthy' metabolic phenotypes, which was not possible using fasting blood-based cytokine levels. Although the ability of the four-cytokine-based postprandial composite biomarker of low-grade inflammation to capture the effects of caloric restriction was limited, this biomarker could show the effects of a whole-grain wheat intervention. While whole-grain wheat reduced the secretion of cytokine mediators, an extended version of the composite biomarker indicated that 20% ER only reduced vascular inflammation, suggesting different underlying mechanisms.

Keywords: low-grade inflammation; composite biomarker; mixed-meal challenge test; postprandial; nutritional interventions

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