Ultra-processed Foods, Diet Quality, and Cardiometabolic Health: An Inter-disciplinary Trans-Atlantic Collaborative Project (Project Number 2R01DK120870-06)

SUN, QI (HARVARD UNIVERSITY)

Frank Hu, Eric Rimm (Harvard University), Jayne Woodside (Queen's University Belfast), Lorraine Brennan (University College Dublin)

Project Summary/Abstract Ultra-processed foods (UPFs) prevail in the U.S. and account for ~60% total energy consumed by Americans. Fast-accumulating evidence from epidemiological studies shows unequivocal evidence that total UPF intake is linked to detrimental health outcomes. In thus far the only randomized, domiciled trial by Hall et al, diets enriched with UPFs led to excess energy intake and weight gain. Yet, the current knowledge base regarding UPFs does not address a critical question that whether the UPF intake's health effects are independent or driven by diet quality. Indeed, our own work suggests that there is a clear heterogeneity among individual foods groups within the broad UPF category in terms of associations with cardiometabolic diseases. For example, sugary drinks, processed meats, ready-to-eat mixed dishes were associated with adverse health outcomes, whereas the opposite was observed for UPF versions of whole grains, cereals, or yogurt. Apparently, diet quality and UPF may influence human health independently, although this hypothesis has not been explicitly examined. To address this critical knowledge gap, in this competing renewal we propose to accomplish four primary aims: 1) to conduct a 6-week feeding trial for discovering and establishing a metabolomic signature of improved diet quality measured by the adherence to a healthy plant-based diet index (hPDI) that de-emphasizes UPFs; 2) to conduct a 4-month feeding trial to compare metabolic health effects between two hPDIs that emphasize UPFs and non-UPFs, respectively, and to derive a second metabolomic signature of food processing that is independent of diet quality; 3) to critically evaluate the two signatures and their individual metabolite components in observational studies in terms of how well they reflect diet quality and UPF intake; and 4) to examine prospectively the metabolomic signatures and individual metabolites in relation to coronary heart disease (CHD) in four well-characterized U.S. cohorts of diverse racial/ethnic backgrounds. These complementary, interdisciplinary, inter-connected projects will be led by an investigator team consisting of established researchers in the U.S., Ireland, and Northern Ireland with expertise in feeding trials, metabolomics, biomarker research, chronic disease epidemiology, and bioinformatics. The proposed projects will be jointly funded, without overlapping jurisdictions, by the NIH, Health Research Board and Science Foundation Ireland in Republic of Ireland, and the Health and Social Care R&D Division in Northern Ireland through the US-Ireland R&D Partnership Programme, which has fostered trans-Atlantic collaborations for 17 years. These projects will lead to novel evidence that dissects health impacts by diet quality and UPF intake, discoveries of novel metabolomic signatures of diet quality and UPF intake, respectively, and valuable data that link the two signatures and CHD risk in U.S. individuals. This study has a great potential to inform the development of new dietary guidelines and more precise dietary interventions that target UPF intake for improving cardiometabolic health.

Public Health Relevance Statement

Ultra-processed foods (UPFs) constitute a single most important source of energy for U.S. diets, although the current evidence does not lead to a clearcut understanding of whether the health effects of UPF intake are independent or driven by diet quality. The proposed investigation aims to generate evidence through inter- connected clinical trials and observational studies for deepening our understanding of health effects by food processing that is independent of diet quality, discovering and critically evaluating objective metabolomic signatures of diet quality and food

processing, and examining prospectively the signatures in relation to heart disease risk. The proposed research will yield much-needed, novel evidence that may lead to refined dietary guidelines and precision nutrition strategies that focus on UPF intake for improving cardiometabolic health.