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DOES BROWN FAT ACTIVITY MEDIATES THE VASCULAR BENEFICIAL EFFECTS OF DIETARY STRAWBERRY?

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Abstract

Background: Cardiovascular diseases (CVD) are the leading cause of death worldwide (WHO, 2020). Annual health care costs in the United States alone total \$214 billion with an additional \$138 billion in lost job productivity. Risk factors including hypertension, hyperglycemia, hypercholesterolemia, dyslipidemia, atherosclerosis, diabetes, and obesity have become commonplace. Half of all Americans are afflicted with at least one of the key risk factors. Because the rapidly declining health of societies worldwide reflects shifts in modern lifestyle, addressing dietary factors serves as an effective functional approach to reduce the toll of CVD. Emerging evidence indicates that activation of brown adipose tissue (BAT) reduces many CVD risk factors. Indeed, BAT activation may be a potential strategy for the prevention and/or treatment of CVD. Our lab recently showed that dietary supplementation of strawberry suppresses vascular inflammation (a key step involved in the development of atherosclerosis) in diabetic and high-fat diet (HFD)- fed mice. However, it is unknown whether this improvement in vascular complication is associated with increased BAT activity. Our objective was to investigate the mechanism whereby strawberry supplementation improves vascular health and its relationship to BAT activation.

Methods: C57BL/6J mice obtained from Jackson Laboratories were fed either a standard diet (control) containing 10% fat or a HFD containing 45% fat. Additionally, subgroups of control and HFD received freeze dried strawberry powder supplementation at a dosage of 2.35% w/w in their diet. This dosage is physiologically equivalent to 2 human servings (160g fresh strawberries). At the end of a 12-week treatment period, the mice were anesthetized, and BAT samples were collected and stored at -80°C for further analysis. mRNA expression of specific genes involved in BAT activity was assessed using qPCR. RNA was extracted from BAT samples using the Qiagen RNeasy Plus Mini Kit. This RNA served as a template to synthesize cDNA using the Qiagen Reverse Transcription Kit. The expression of these biomarkers in various BAT samples was measured using Qiagen SYBR Green PCR Kit. Copy numbers of cDNA targets were quantified using Ct values to determine respective gene expression calculated by normalizing to the level of the housekeeping gene GAPDH.

Results & Discussion: The relative expression of UPC1, PGC1 α , and COX-2 enabled the assessment of the degree of BAT activity at the transcriptional level. Expression of UPC1 and PGC1 α at the transcriptional level was drastically reduced in HFD mice compared to control mice. Strawberry supplementation significantly improved PGC1 α expression in HFD fed mice. The expression of COX-2 was similar among the groups. Our study suggests dietary strawberry supplementation may play a possible role in the activation of BAT, though further analysis is required. Ongoing studies focus on identifying the effect of dietary strawberries on the expression of additional genes involved in BAT metabolic function. Our study will determine whether the vascular beneficial effects of strawberries are mediated through enhancing brown fat activity.