Implications of the Impact of Dietary Supplements on Cardiovascular Health Through Gut Microbiome Production of Trimethylamine-N-Oxide

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Atherosclerosis is a cardiovascular disease that causes plaque buildup within the arterial inner lining, and 42.1% of adults with no other known heart disorder suffer from the illness. Atherosclerosis is associated with gut microbiota and is exacerbated by the intake of common dietary compounds, like L-arginine, Phosphatidylcholine, Choline Bitartrate, and L-carnitine. When ingested, these compounds are metabolized into trimethylamine (TMA) by the gut microbiome. TMA is then oxidized into trimethylamine-N-oxide (TMAO) by hepatic enzymes. Previous research has shown that TMAO is correlated with an increased risk of cardiovascular events. Our project quantifies the impact of the four previously mentioned compounds on the growth of Escherichia coli (E. coli), a model organism for the gut microbiome, using a growth assay. Since E. coli growth may not be proportional to TMAO production, we developed a TMB/peroxidase-derived colorimetric assay to directly measure TMAO levels. From the growth assay, we found that Choline Bitartrate has the greatest positive impact on the growth of E. coli, and Phosphatidylcholine and L-Arginine inhibited E. coli growth after 48 hours. Using our colorimetric assay we determined that, after 48 hours of incubation, Choline Bitartrate significantly increases TMAO synthesis in the presence of introduced bovine hepatic enzymes. Our research highlights the impact of specific dietary supplements on human cardiovascular health through interactions with the gut microbiome using in vitro systems. The goal of the research is to guide the dietary intake of specific compounds that are not universally associated with cardiovascular health by high-risk individuals.

Awards Won: