Chronic stress (CS) is a significant public health concern associated with numerous adverse health outcomes, including metabolic disorders, cancer, mental illnesses, and cardiovascular diseases (CVDs). While an acute stress response is short-lived and usually resolves on its own once the stressful situation subsides, chronic stressors characterized by uncontrollability and unpredictability can induce a stress response that damages body functions and increases susceptibility to chronic diseases. Monocytes, pivotal in immune defense, are affected by CS-induced myelopoiesis, contributing to chronic disease progression. Dietary interventions targeting the microbiome show promise in alleviating CS-related stress via the gut-brain axis, particularly through increased production of short-chain fatty acids. Peanuts are low-cost and readily accessible food rich in micronutrients, monounsaturated fatty acids, prebiotic fiber, and bioactive compounds. They demonstrate potential in modulating gut microbiota and reducing inflammation, thus impacting CVD risk and psychological well-being. To address these issues, a randomized crossover study will assess the impact of peanut consumption on individuals with high and low perceived CS levels, gastrointestinal health, the physiological and psychosocial stress on immune function. Understanding the interplay among CS, the immune system, the microbiome, and exploring accessible interventions, holds significant implications for environmental health in addressing the escalating prevalence of chronic stress.