Abstract

Microgravity experienced during spaceflight is known to adversely impact astronauts’ health that may lead to serious acute and chronic inflammatory disease. In ground-based space flight models, there is evidence of immune compromise and reactivation of latent viral infection. A dysregulation in immune function is believed to a key mediating factor. To further define the mechanisms mediating microgravity-induced immune dysfunction, it is important to develop ground-based analogs and methodology that depict microgravity conditions. The long-term goal of our studies is to identify mechanisms through which microgravity alters immune function that can be used to develop interventions to protect astronauts’ health. The purpose of the current study is to develop a ground-based in vitro system to determine the effects of microgravity on leukocytes function. Using primary murine splenocytes, we determined the effect of simulated microgravity on CD4 positive and CD8-positive T cells. We hypothesized that exposure to ground-based microgravity would globally decrease the percentage of total CD4+ and CD8+ T cells and effect splenocyte cytokine production. Results demonstrated that splenocytes exposed to microgravity when stimulated in vitro with anti-CD3, resulted in a decrease in the percentage of CD4/CD8, but a slight increase in CD8 control T cells. Currently we are conduction pilot studies to measure IL-17A, IL-10, IL-4, IFN-Gamma and IL-6 when simulated in vitro. Results show that Lipopolysaccharide (LPS) stimulation increased IL-17A production by splenocytes. Studies in progress are determining the effect of microgravity on cytokine production when stimulated with anti-CD3.

Introduction

As astronauts are the great men and women children inspire to be just like “when they grow up.” They face extreme conditions that could lead to a lifestyle changing results. These harmful conditions can be life changing effects on the immune system. The human body isn’t foreign to earth’s gravity (static), as the effect of one weighing less on the moon than the earth. Though the immune function could also be affected by the sudden change in gravity. That in-balance of the body could lead to an individual on-going lifestyle changing sickness and disease. During space travel astronauts face mental battles that could stress the body out. Astronauts taking on the responsibility of serving our country facing sleep disruption, isolation, and containment on missions. Affecting both the innate and adaptive immune system is the body’s very own defensive attempt to keep one body healthy. With innate system being like nose hair, eyelashes, to keep parts from any kind of micro-biomes that could cause an allergic reaction. Sneezing multiple times is an allergic reaction for pollen for some, though in this case when the body is exposed to microgravity it causes a dysregulation in immune function. With possible long-term effects weakening ones’ immune system leading to infections. Leading to disease costing one's life on earth ever being the same or worst. Reported, as astronaut Fred Haise (Apollo 13) was infected by an opportunistic bacterium, *Pseudomonas aeruginosa*, during spaceflight.
Materials and Methods

Establishing a ground base method to study the effect of microgravity on immune function. Using three conditions to stimulate these harvest cells (leukocytes) from stressed and non-stressed naive mice. Results will show how these leukocytes will be affected in microgravity, stimulated with three controls. Our Control (C) being the effects on the mouse’s cultured splenic leukocytes on microgravity and desktop (static/earth’s gravity). Along with Lipopolysaccharides (LPS) and CD3 antibody which services as an protective layer bacteria in its surroundings also simulating the cells. Placed overnight and extracted the next morning we placed this cells in RPMI wash media (supernatant) to help culture the cells. Extracting the supernatant to test the production of cytokines (IL-17A). After preparing the cell for staining for Flow Cytometry staining the cells to detect CD3-PE, CD4-PE Cy7, and CD8-FITC. Looking at the cells that were detected in the cell staining to record and analysis any irregularity of any kind.

Results

Conclusion