Abstract

Organisms possess sophisticated defense mechanisms to maintain homeostasis and combat threats. The immune system plays a pivotal role in this defense, recognizing and responding to threats from both the internal and external environments. While the influence of various factors on the immune system is well recognized, the effect of temperature remains an area of significant interest. The complex interplay between thermogenic stimuli and immune responses is explored in this dissertation.

Initially, we investigated the effects of high temperature-dependent TRPV1 channel activation in macrophages. The results obtained demonstrate that TRPV1 activation by capsaicin in an inflammatory environment induces a phenotypic shift in macrophages from pro-inflammatory M1 to anti-inflammatory M2b-like. This transition is accompanied by alterations in cytokine production, up-regulation of co-stimulatory molecules, and enhanced T cell proliferation.

Secondly, we investigated the effects of chronic cold exposure on the immune system in a rat model. Our observations revealed substantial changes in the immune system during the process of cold acclimatization, including an increase in the abundance of γδ T cells in various tissues. These findings suggest a critical role for γδ T cells in the regulation of thermogenesis. Furthermore, we observed that cold exposure altered the immune response to TLR2 and TLR4 stimulation, highlighting the profound impact of temperature on immune function. Finally, we translated some of these findings to human subjects. Specifically, we observed an increase in the population of γδ T cells in the blood of volunteers who regularly swim in cold water, in comparison to a control group.

This dissertation offers novel insights into the intricate relationship between thermogenic stimuli and the immune system. The findings underscore the potential for targeting TRPV1 and γδ T cells to modulate immune responses. The implications of these findings are significant, as they offer novel perspectives on comprehending and potentially manipulating the immune system under various physiological and pathological conditions.