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Acute HIIT preferentially mobilizes virus-reactive CD8+ T cells and enhances leukocyte migratory capacity

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Physical activity induces rapid, selective leukocyte mobilization, thereby modulating immune surveillance. Among the most responsive cell types to high-intensity exercise are NK and CD8+ T cells, key effectors of immune defense against infected and malignant cells. However, comprehensive characterization of acute high-intensity interval training (HIIT)-induced effects on leukocyte populations is limited. We collected peripheral blood from 23 healthy participants undergoing a supervised, group-based HIIT session at baseline, immediately post-exercise (ex02), and 1h post-exercise (ex60). Cell counts were quantified using clinical-grade flow cytometry. CD8+ T cells were analyzed for memory and differentiation status and virus peptide reactivity using DNA-barcoded peptide-MHC multimer staining targeting 250 peptides. Chemokine receptor expression (CX3CR1, CXCR2, CXCR4, CCR2, CCR5) and ligand regulation were evaluated via flow cytometry and Olink proteomics. Associations between individual characteristics –fitness, sex, body composition, and age –and CD8+ T cell mobilization were analyzed. Chemokine receptor expression on $CD4^+$, γδ T cells, NK cells, and monocytes was profiled using flow cytometry and FlowSOM clustering. A single HIIT bout induced robust cell type-specific mobilization followed by substantial egress, consistent across fitness levels, body composition and age. NK, γδ and CD8+ T cells were the most HIIT-responsive cell types. Catecholamines NE and EPI peaked post-exercise, and NE was selectively associated with CD8+ T cell mobilization. Memory subsets were reorganized, reducing terminally differentiated and $CD57^+$, $PD\text{-}1^+$, and CD28neg cells at ex60 post exercise. Circulating virus-reactive T cells increased across 12 virus types. HIIT modulated chemokine receptor profiles in a cell type-specific manner –CD56dim $CX3CR1^+$ $CXCR2^+$ NK cells and two populations of CD8+ T cells with distinct chemokine receptor patterns were preferentially mobilized. Acute HIIT mobilizes functional, virus-reactive CD8+ T cells with features indicative of enhanced migratory and activation potential, supporting translational use from tumor immunology to infectious diseases.The study is registered at clinicaltrials.gov (NCT05826496).

Keywords

acute exercise; adaptive immunity; chemokine receptor; endurance exercise; exercise immunology; migration

Conflict of Interest & Ethical Approval

yes

Abstract submitters declaration

yes

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