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IN THE HELMHOLTZ ASSOCIATION

Contribution ID: **69** Type: **1 - Scientific Poster**

Exercise Timing as a Determinant of Anti-Cancer Efficacy

Thursday 23 July 2026 12:40 (20 minutes)

The circadian system, essential for adapting to cyclic environmental changes, imposes temporal timeframe on physiological functions and plays a critical role in health maintenance and disease prevention. Building upon our prior work demonstrating time-of-day-dependent effects of exercise on metabolic activation, our laboratory is developing chronobiology-based strategies that leverage exercise timing to enhance disease prevention and therapy. Although the anti-cancer benefits of exercise are well established, a critical and largely unanswered question remains: Does the timing of exercise influence its tumor-suppressive efficacy? Our preliminary studies in a murine model of triple-negative breast cancer reveal that exercise performed at the early active phase (analogous to early morning in humans) produces markedly stronger tumor-suppressive effects than exercise performed at the late active phase (analogous to late evening in humans). These findings highlight exercise timing as a potential modifiable factor to optimize cancer therapeutic outcomes. To advance the development of time-optimized exercise interventions for cancer therapy, our ongoing work investigates the molecular mechanisms underlying these time-of-day-dependent effects. Notably, our recent data show that the enhanced tumor suppression observed with early active phase exercise coincides with selective upregulation of Period1 (PER1), a circadian regulator with tumor-suppressive functions, and its upstream transcriptional activator, the glucocorticoid receptor (GR), a well-established modulator of tumor biology, within tumors. These observations led us to hypothesize that the GR-PER1 axis serves as a central mechanism linking exercise timing to anti-tumor signaling. We are currently testing this hypothesis by determining whether GR signaling and/or the GR-PER1 pathway mediates the time-specific, tumor-suppressive response to exercise. Collectively, our findings provide foundational evidence supporting chronobiology-informed, precision exercise prescriptions to enhance cancer prevention and treatment. I look forward to sharing our latest unpublished findings with the ISEO community and to building collaborations within the field of exercise oncology.

Keywords

Exercise timing, Circadian rhythms, Triple-negative breast cancer mouse model, Glucocorticoids

Conflict of Interest & Ethical Approval

yes

Abstract submitters declaration

yes

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Session Classification: Poster Session