

Wearable Technology and Artificial Intelligence for Health and Performance Optimization in Division 1 Female Soccer Athletes

WHITNEY HAYLEY, AMITRANO JOSEPH, LEWANDOWNSKI GINA, CALABRESE LAUREN, & SESHADRI DHRUV

Seshadri Lab; Bioengineering; Lehigh University; Bethlehem, PA

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Advisor / Mentor: Seshadri, Dhruv (dhs223@lehigh.edu)

ABSTRACT

Funding for female athletes is at a significant disadvantage, with male sports funded at a rate twice as high. Female athletes also experience ACL injuries at a rate 2 times higher than their male counterparts. Division I sports face significant disparities in funding, particularly affecting support tools and resources available for female athletes. The study aims to bridge this clinical gap in sports medicine. **PURPOSE:** The purpose of this study is to assess how AI can leverage data from wearable technologies to create an understanding of athlete health, allowing for personalized and optimized training programs, with a particular focus on the menstrual cycle's effects on performance metrics. **METHODS:** This longitudinal study monitored thirteen female soccer athletes at Lehigh University using WHOOP wrist monitors and PlayerData GPS vests. WHOOP wrist monitors (August 2023 to October 2024; 55,839 data points) and PlayerData (August 2024 to October 2024, 2,730 data points). The study integrates menstrual cycle data to assess its correlation with performance and recovery metrics. Data analysis utilized a logistic regression model to develop a predictive analytics platform focusing on physiological stress. **RESULTS:** The WHOOP-derived strain platform for predicting high strain (>14) demonstrated predictive capabilities with an accuracy of 89.44%, sensitivity of 90.59%, and specificity of 88.19%, effectively identifying high and low physiological stress markers. We hope that as more data are collected, the inclusion of menstrual cycle data will enhance the comprehensiveness of the performance analysis, enabling more tailored health management and optimization strategies for female athletes. **CONCLUSION:** Integrating AI with wearable technologies has proven highly effective in monitoring and enhancing athlete performance. The approach provides valuable insights into the specific needs of female athletes, emphasizing the critical role of menstrual cycle monitoring in sports science. This study sets the stage for scalable, personalized athlete health management system to address a critical, underfunded need in sports medicine.