GNYACSM Original Research Abstract

Bioinformatics to Guide Musculoskeletal Modeling: A Retrospective Study from Olympic Water Polo Athletes

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ABSTRACT

There is a pressing need for effective injury prevention methods to mitigate time-loss injuries. This study aims to develop a robust injury risk assessment model for water polo athletes by assessing the interplay between load-response metrics, and leveraging artificial intelligence to forecast wellness based on prior assessments. **PURPOSE** Water polo athletes present with upper extremity injuries in the hip, knee, and elbow due to the physical demands of the constant treading of water coupled with the overhead throwing motions required to compete. There lacks longitudinal data to ascertain workload injury relationships in water polo. This study addressed this shortcoming by studying load-response relationships on Olympic water polo athletes during training and performance over a two-year period. **METHODS** Load response variables, such as energy, sleep duration, and acute to chronic workload ratio (ACWR) were studied on thirteen female Australian Olympic water polo athletes from 2019-2021 spanning 17,000 data points. Tests such as Shapiro and ANOVA tests were used to correlate workload and wellbeing profiles to injury risk. The training load and wellbeing metrics were compared for the least and most injured athletes ($p < 0.05$ deemed statistically significant). Principal component analysis (PCA) clustering was used to identify a linear combination of variables that captures their interrelationships, optimizing data representation through dimensionality reduction, creating optimized variables. **RESULTS** The most injured athlete tended to exhibit higher average ACWR values (1.15 + 0.4) compared to uninjured counterparts (1.13 + 0.4), ($p = 0.874$). Injured athletes had wellness metrics that were 10% higher compared to uninjured athletes. The most injured athlete reported slightly higher average energy, (1.14 ± 0.6), when compared with the least injured athlete, (1.14 ± 0.6). The PCA model accounted for 91% of variance in the data. **CONCLUSION** Self-reported wellbeing metrics alone may not suffice for comprehensive athlete wellness assessment. The integration of wearable technology with subjective assessments would provide both objective and subjective data to augment the predictive power of such models thereby enabling the development of athlete-specific training and rehabilitation protocols.