Introduction

Strength and jump landing mechanics are often used to assess an athlete's readiness for competition. The interpretation of these measurements is limited due to the high dimensionality of the data, resulting in poor communication of in-lab measurements to coaches and athletic performance practitioners. The purpose of this study was to assess the predictive relationship between preseason in-lab testing and in-game acceleration and to develop a predictive composite metric using principal component analysis (PCA).

Methods

Twenty-four Division I female soccer athletes (Height:153.2±173.3cm, Weight:48.4±72.8 kg, Age:18.0±23.3 years) underwent preseason testing, which included drop vertical jump (DVJ) trials to evaluate landing force and loading rate, along with unilateral isokinetic knee extension and flexion assessments to measure peak strength. Two linear regression models were developed: 1) using raw testing data, 2) using PCA score data.

Results

The raw data model demonstrated a strong relationship between strength and landing mechanics with in-game acceleration (r^2= 0.52, p = 0.08). Component 12 was the most associated composite metric to in game acceleration (r = -0.47, p = 0.03). The linear model fit to the data projected onto component 12 demonstrated a weak relationship to in-game acceleration (r^2 = 0.19, p = 0.03).

Discussion

The raw data model showed that knee flexion and extension strength and landing mechanics may predict in-game performance. Additionally, PCA revealed meaningful composite metrics linked to performance. However, despite moderate association, component 12 explained minimal variance, limiting its predictive power. Future research should explore dimensionality reduction techniques to enhance interpretation and communication of performance predictions.