Which Metrics Matter?
An Empirical Classification of Lower Body Strength in Athletes

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PURPOSE

With an increased availability of strength assessment technology, sport scientists and practitioners are faced with large volumes of strength-related data, raising challenges for interpretation and application. While expressions of strength have been classified several different ways in the literature, no consensus exists on how this classification process should be done. Furthermore, none of the current methods have applied a data-driven approach to empirically-inform the classification process.

The purpose of this study is to **1) empirically classify lower body strength domains**, and **2) determine the most appropriate metric(s) for each domain of strength** with the end goal of simplifying the strength diagnosis process for the end-user.

METHODS

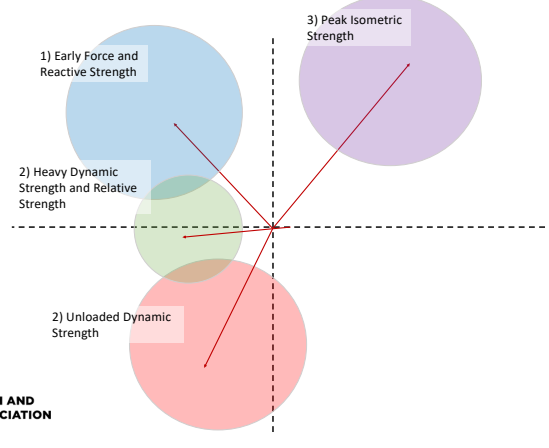
In a cross-sectional design, 63 male and female athletes (age=20.3[2.2]yrs, height=167.9[6.8]cm, body mass=77.3[8.2]kg) completed drop jumps (DJ) from 30, 45, and 60cm, squat jumps (SJ), countermovement jumps (CMJ), loaded (20-60% body mass) CMJs, a 1-rep maximum back squat (1RM) and an isometric squat (ISQ) and isometric mid-thigh pull (IMTP) in both slow-ramp and rapid conditions. Each test apart from the 1RM was performed on portable force plates (ForceDecks Lite, VALD Performance, QLD, Australia). generating 169 force-time bilateral performance metrics.

To reduce the dimensionality of metrics derived from each test, a principal component analysis (PCA) was employed for each test (excluding 1 RM). The top 4 metrics contributing to each principal component were placed into a final PCA model involving all strength tests.

RESULTS

- The PCA models demonstrated that 2 or 3 components accounted for the majority of variance within each test.
- Once the identified metrics were placed into the final, 4 components contained the majority of variance among all strength metrics

A total of **4-8 metrics** obtained from **3-4 tests** capture the spectrum of lower body extensor strength



CONCLUSIONS

These findings support the notion that distinct strength domains exist in athletes, yet this method appears to classify strength differently than other methods [1,4,5]. This suggests that 4, unique domains of strength exist in this cohort:

1) **DJ-RSI; ISQ-instantaneous force (F) at 100ms, F at 150ms, F at 200ms , IMTP – F at 100ms, F at 150ms;**
2) **Loaded CMJ – jump height (JH), 1RM, ISQ – peak force (PF)/body weight, PF/BM;**
3) **ISQ – Net PF, IMTP – Net PF, F at 200ms;**
4) **CMJ – JH ; SJ concentric RFD, CMJ concentric impulse at 100ms.**

PRACTICAL APPLICATIONS

These findings inform the sport scientist and practitioner on how to best classify strength of the lower body for the purpose of simplifying and contextualizing strength diagnosis. These findings also directly inform the selection and interpretation of metrics used to represent lower body strength.

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