SINGLE JOINT ISOMETRIC HAMSTRING STRENGTH IN PROFESSIONAL SOCCER PLAYERS: NORMATIVE BENCHMARKS AND POSITIONAL DIFFERENCES

NICHOLAS RIPLEY[1], Jack Fahey[1], John McMahon[1,3], Christopher Bramah[1], Andrew Badby[1], Paul Sindall[1] and Paul Comfort[1,2]

1) School of Health and Society, University of Salford, Salford, United Kingdom. **2)** School of Medical and Health Sciences, Edith Cowan University, Joondalup, Australia.

3) Hawkin Dynamics, Westbrook, ME, USA.

University of Salford MANCHESTER

@njripley

n.j.ripley@salford.ac.uk

INTRODUCTION

The hamstrings' ability to produce a **large force to overcome the high angular velocities and momentum of the shank** during the terminal swing phase of running is crucial to mitigating injury risk (1). Hamstring strain injuries (HSIs) remain one of the most **prevalent non-contact muscular strain injuries** occurring within team sports (2).

Isometric hamstring assessments, including the **90-90 isometric hamstring strength assessment** (90° hip flexion and 90° knee flexion) and **30-30 isometric hamstring strength assessment** (30° hip flexion and 30° knee flexion), have consistently demonstrated sensitivity to **detect change following a fatiguing activity in both peak force (PF) and rate of force development (RFD)** when using force plates (3-4). However, to date it is not currently known if there are positional differences within soccer in addition to having limited normative data in professional soccer players.

Therefore, the purpose of this study was to **assess professional soccer players with two isometric hamstring strength assessment, providing normative benchmarks and positional differences.**

METHODS

79 senior professional men's soccer outfielders (age; 24.2 ± 5.1 years, height; 183.6 ± 5.8 cm, mass; 81.5 ± 8.1 kg) participated within the present study. Three trials of two different single joint isometric hamstring strength assessments using force plates were performed as part of **pre-season testing (June 2023).** Long lever and short lever tests were performed in a supine position with the knee and hip positioned in **90° of hip and knee flexion (90-90) or 30° hip and knee flexion (30-30), respectively.**

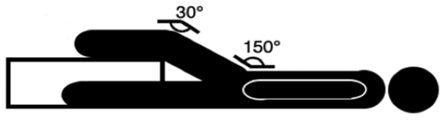
Data was collected using Hawkin Dynamics (HD) force plates and analysed using HD software. Participants were fixed at the hip by the assessor, removed all footwear and hands positioned at the shoulders. Limb dominance was categorised on kicking preference; dominant (DL) and non-dominant limb (NDL). Data were ratio scaled to body mass PF (N/kg).

Acceptable reliability was assessed using coefficient of variation percentage (CV%) and intraclass correlation coefficients (ICCs). Reliability was interpreted based on the associated 95% confidence intervals (CI). Standardised **T-scores (scaled from 0-100) were derived using central tendency and associated variability (mean ± SD) and used to create performance bands with a qualitative description (ranging from extremely poor to excellent) and a traffic light system for ease of data interpretation for coaches and athletes**. A series of repeated measures analysis of variance (ANOVA) with Bonferroni post-hoc analysis and Cohen's *d* effect sizes used to examine positional differences between outfield players. All statistical analysis wer completed using JASP statistical software. *P* value was set at 0.05.

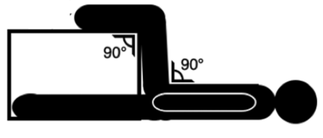
RESULTS

A **non-significant main effect was observed between test positions** (p>0.05, η^2), with **trivial-small, yet non-significant pairwise differences between positions** for each test (p>0.203, d = 0.01-0.47).

Strikers were the weakest across all positions, whereas **midfielders were stronger on the NDL limb for both the 90:90 and 30:30 and defenders were stronger on the DL, although these differences were trivial-small. Normative data is provided within Table 1.**



30:30 Isometric Knee Flexor Test



90:90 Isometric Knee Flexor Test

Figure 1. Visual representations of the 90-90 and 30-30 Isometric hamstring assessment set up positions

Table 1. Normative data for isometric hamstring assessments for professional soccer players between the national league and league 2.

Description	T-Score	DL 30-30 rPF (N/kg)	NDL 30-30 rPF (N/kg)	DL 90-90 rPF (N/kg)	NDL 90-90 rPF (N/kg)
World Class	>80	>6.59	>6.46	>6.63	>6.58
Excellent	70-80	5.87-6.59	5.74-6.46	5.91-6.63	5.87-6.68
Very Good	65-70	5.51-5.87	5.38-5.74	5.55-5.91	5.51-5.87
Good	60-65	5.15-5.51	5.03-5.38	5.20-5.55	5.15-5.51
Above Average	55-60	4.80-5.15	4.67-5.03	4.84-5.20	4.79-5.15
Average	45-55	4.08-4.80	3.95-4.67	4.12-4.84	4.07-4.79
Below Average	40-45	3.72-4.08	3.59-3.95	3.76-4.12	3.72-4.07
Poor	35-40	3.01-3.72	2.88-3.59	3.05-3.76	3.00-3.72
Very Poor	30-35	2.65-3.01	2.52-2.88	2.69-3.05	2.64-3.00
Extremely Poor	<30	<2.65	<2.52	<2.69	<2.64

DL = Dominant limb, NDL = Non-dominant limb, 30-30 = 30-30 Isometric hamstring assessment, 90-90 = 30-30 Isometric hamstring assessment, rPF = relative peak force

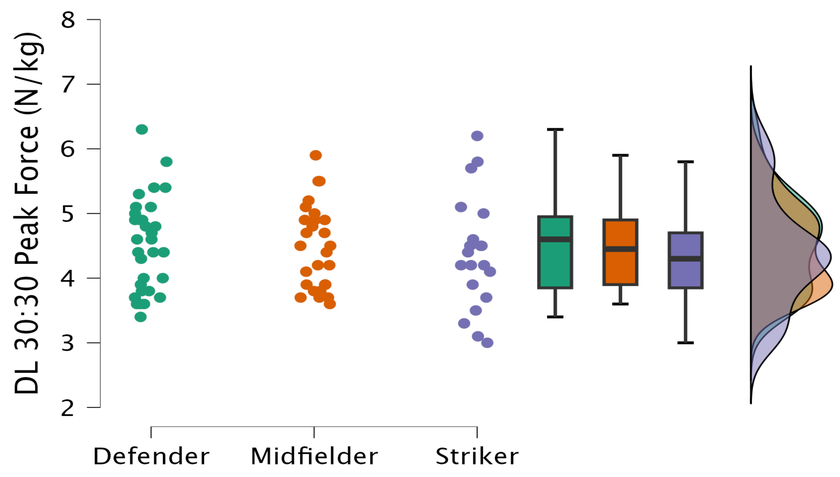


Figure 2. Positional difference for DL 30-30 Isometric hamstring assessment.

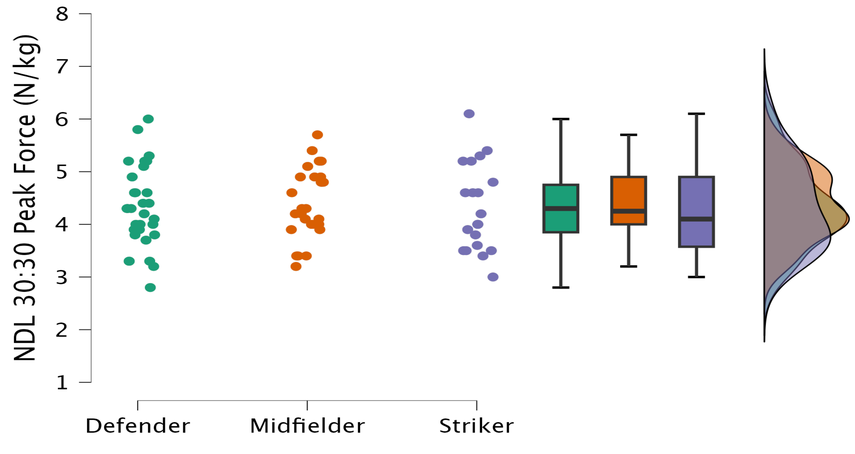


Figure 3. Positional difference for NDL 30-30 Isometric hamstring assessment.

CONCLUSIONS

There were **minimal differences between outfield positions** in relative isometric hamstring strength in the 30:30 and 90:90 assessments (Figure 2-5). Strikers were the weakest, although non-significant to other positions.

PRACTICAL APPLICATION

Despite meaningful **differences in movement characteristics between positions (5),** they all exhibit **similar levels of isometric hamstring strength**. This could present an issue for **midfielders or attackers** who will commonly perform **greater volumes of high-speed running** and **sprinting**, which is a task commonly associated with HSI incidence

Practitioners can use the **normative data presented in Table 1** to identify training needs of athletes, with a qualitative description provided for interpretation between practitioners within the multi-disciplinary team.

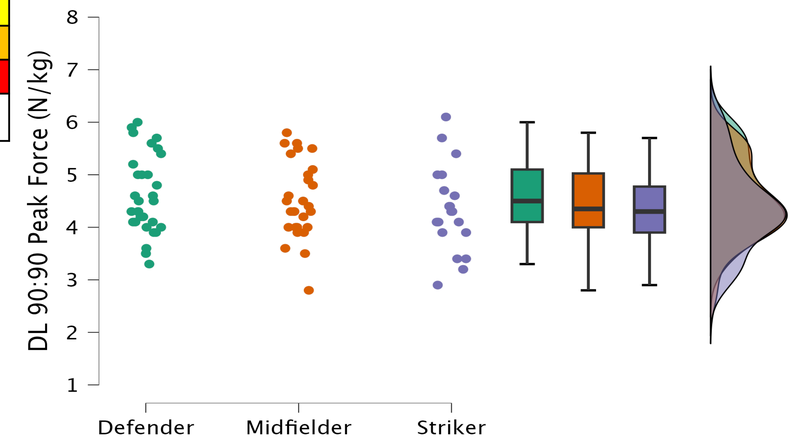


Figure 4. Positional difference for DL 90-90 Isometric hamstring assessment.

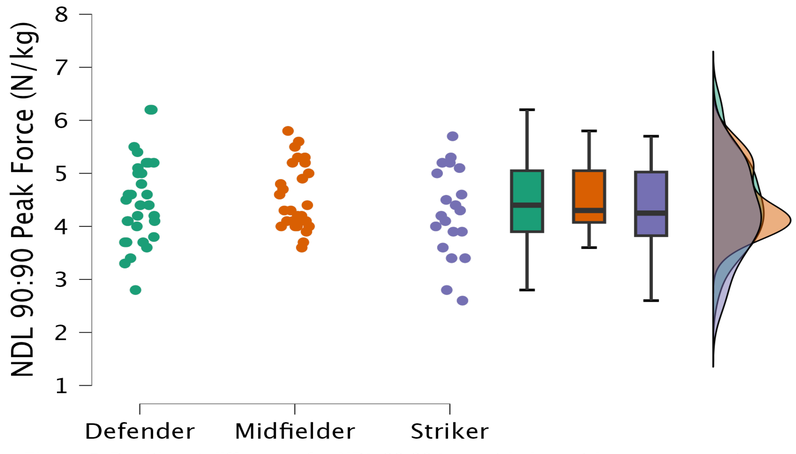


Figure 5. Positional difference for NDL 90-90 Isometric hamstring assessment.

REFERENCES

1) Chumanov ES, Heiderscheit BC, and Thelen DG. Hamstring musculotendon dynamics during stance and swing phases of high-speed running. *Med Sci Sports Exerc* 43: 525-532, 2011.

2) Ekstrand J, Bengtsson H, Waldén M, Davison M, Khan KM, and Hägglund M. Hamstring injury rates have increased during recent seasons and now constitute 24% of all injuries in men's professional football: the UEFA Elite Club Injury Study from 2001/02 to 2021/22. *British Journal of Sports Medicine* 57: 292-298, 2023.

3) Bettariga F, Bishop C, Martorelli L, Turner A, Lazzarini SG, Algeri C, and Maestroni L. Acute Effects of a Fatiguing Protocol on Peak Force and Rate of Force Development of the Hamstring Muscles in Soccer Players. *Journal of Science in Sport and Exercise*, 2023.

4) McCall A, Nedelec M, Carling C, Le Gall F, Berthoin S, and Dupont G. Reliability and sensitivity of a simple isometric posterior lower limb muscle test in professional football players. *Journal of Sports Sciences*, 2015.

5) Bloomfield J, Polman R, O'Donoghue P. Physical Demands of Different Positions in FA Premier League Soccer. J Sports Sci Med. 2007 Mar 1;6(1):63-70. PMID: 24149226; PMCID: PMC3778701.