2024/25

Premier League Report

VALD

Premier League

Contents

In this document, we will **cover a wide range of topics and answer some common questions**, including:

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Testing and **Beyond**

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- Nordbord Trends

Archetypes

- **Premier League**
- **Other European Leagues**
- Hip Adductor vs.Nordic Strength

The Premier League and VALD

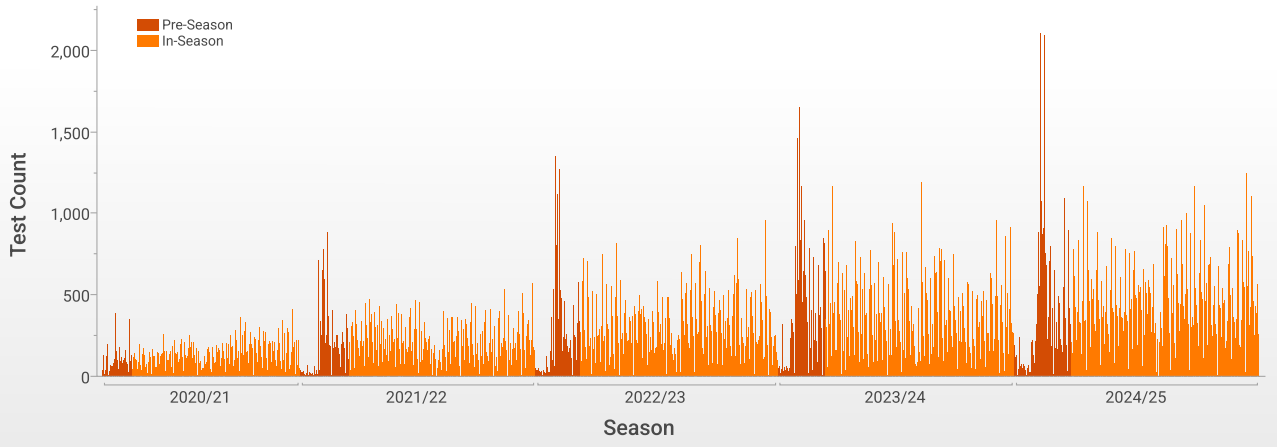
To our clients: thank you for your continued support throughout the 2024/25 season.

VALD's journey in the Premier League began over a decade ago with the NordBord – marking the start of a new era in athlete monitoring and objective performance measurement. Since then, VALD systems have become integral to the operations of every Premier League club and beyond, including the following:

- 32 out of the 36 **UEFA Champions League** clubs
- Every **Women's Super League** club
- Every **Championship** club
- Every **League 1** club
- 19 out of 24 **League 2** clubs
- Every **Premier League Academy**

Since the 2020/21 preseason...VALD technologies have been **used by Premier League clubs on 1,733 out of 1,764 days.**

Since the 2020/21 preseason through to the end of the 2024/25 season, VALD technologies have been used by Premier League clubs on 1,733 out of 1,764 days. This near-continuous activity demonstrates the importance of objective data for assessing, monitoring and enhancing athlete performance and wellbeing.



The 2024/25
Premier League Season

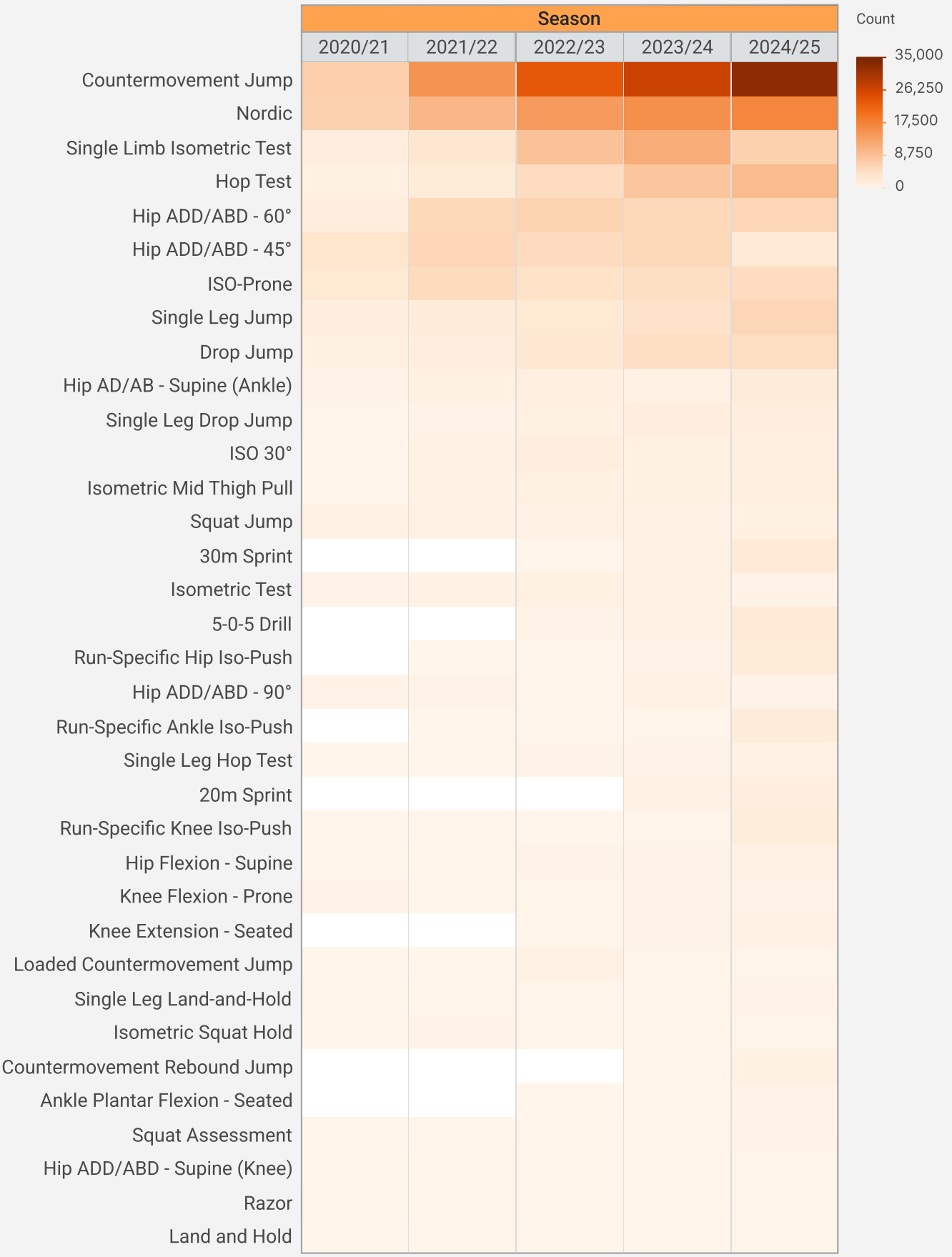
This season marked the largest dataset ever captured in a single Premier League season, with over 140,000 tests uploaded to VALD's Data Lakehouse. This magnitude and scale of testing offers an unprecedented opportunity to deliver meaningful insights back to the clubs and practitioners who drive performance forward.

[Season 2024/25] marked the largest dataset ever captured in a single Premier League season, with **over 140,000 tests uploaded…**

This report presents population-level analyses drawn from data captured predominantly from the NordBord, ForceFrame and ForceDecks systems, providing normative values and trend insights across the league – not limited to a single club or cohort.

Key Applications of this Data

- Performance profiling
- Load-response and readiness monitoring
- Injury risk reduction and rehabilitation
- Return-to-play decision-making


Season
2020/21
2021/22
2022/23
2023/24
2024/25
Countermovement Jump
Nordic
Single Limb Isometric Test
Hop Test
Hip ADD/ABD - 60°
Hip ADD/ABD - 45°
ISO-Prone
Single Leg Jump
Drop Jump
Hip AD/AB - Supine (Ankle)
Single Leg Drop Jump
ISO 30°
Isometric Mid Thigh Pull
Squat Jump
30m Sprint
Isometric Test
5-0-5 Drill
Run-Specific Hip Iso-Push
Hip ADD/ABD - 90°
Run-Specific Ankle Iso-Push
Single Leg Hop Test
20m Sprint
Run-Specific Knee Iso-Push
Hip Flexion - Supine
Knee Flexion - Prone
Knee Extension - Seated
Loaded Countermovement Jump
Single Leg Land-and-Hold
Isometric Squat Hold
Countermovement Rebound Jump
Ankle Plantar Flexion - Seated
Squat Assessment
Hip ADD/ABD - Supine (Knee)
Razor
Land and Hold
Count
35,000
26,250
17,500
8,750
0

What Will I Get From This Report?

This report aggregates data collected during the 2024/25 season from all Premier League clubs using VALD's suite of measurement systems. It includes population-level insights that can help clubs profile and contextualize their own athlete data within the broader Premier League landscape.

Key features of this report include:

- **Normative data** for tests captured during both the pre-season and in-season
- **Most popular tests** and testing trends based on usage behavior
- **Selection of key metrics** based on expert insights for deeper analysis and interpretation
- **Seasonal trends** and emerging performance insights offering teams potential opportunities to refine their monitoring, assessment and training practices
- **Between-league comparisons** allowing clubs outside the Premier League to determine how their athletes and teams stack up

Ultimately, this report is designed to help…**optimize performance, manage injury risk and enhance return-to-play protocols.**

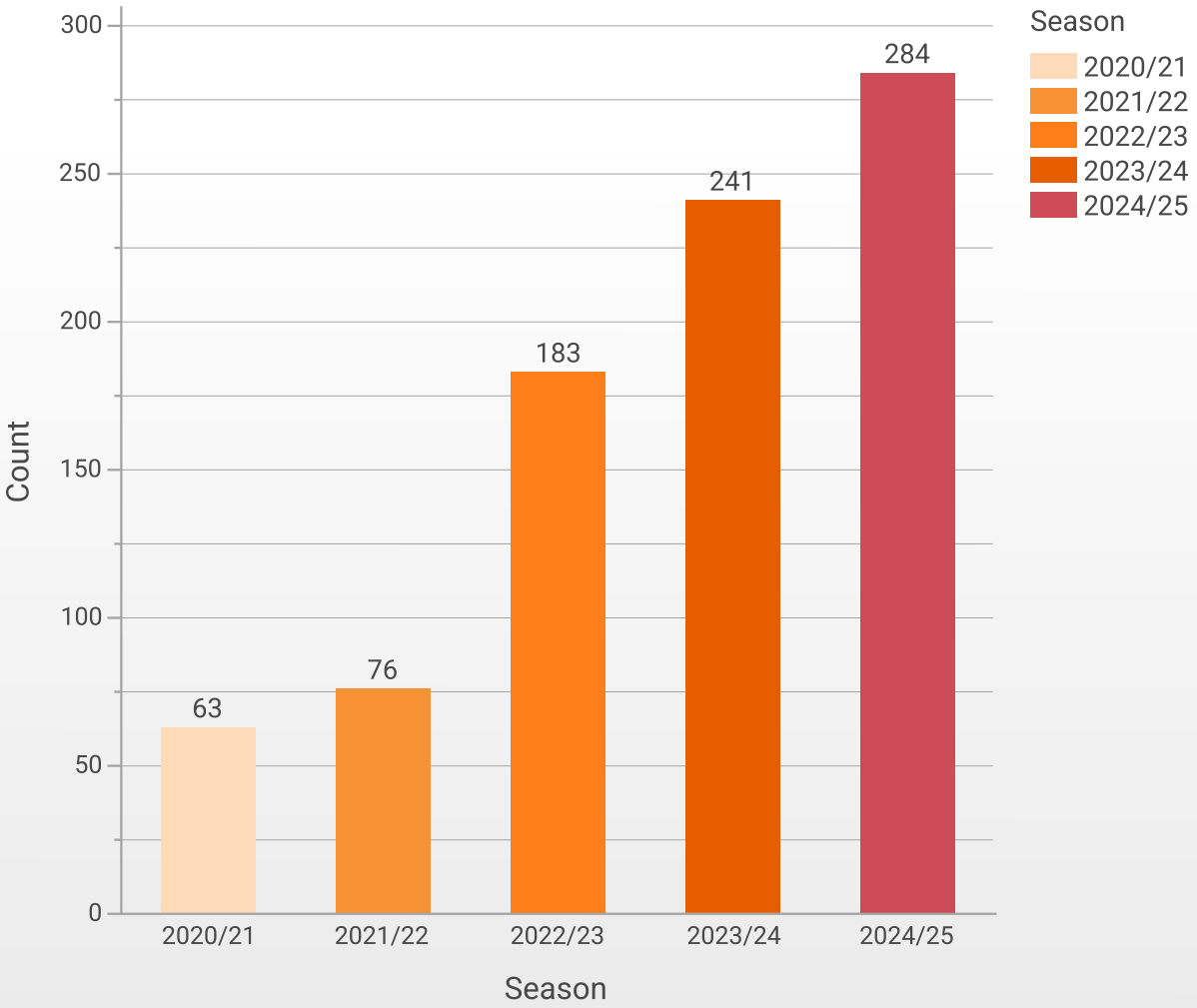
Ultimately, this report is designed to help practitioners make data-informed decisions to optimize performance, manage injury risk and enhance return-to-play protocols.

Which **Tests** Does This Report Cover?

In the 2020/21 season, clubs conducted **63 unique test types…**

By the 2024/25 season, that number had grown to **284 unique test types…**

VALD's ability to deliver high-quality performance and health data has expanded significantly over time. In the 2020/21 season, clubs conducted 63 unique test types using VALD systems. By the 2024/25 season, that number had grown to 284 unique test types, reflecting the increased breadth and sophistication of musculoskeletal assessments in the Premier League.



The number of unique test types uploaded to the VALD Data Lakehouse by season. As VALD systems have evolved to enable more test types, Premier League testing has expanded to take full advantage of them.

Most notably in 2024/25, new isometric testing options such as Alex Natera's Run-Specific Isometric tests have quickly risen in popularity.

…new isometric testing options such as **Alex Natera's Run-Specific Isometric tests have quickly risen in popularity.**

The tests with the greatest use were:

VALD System	Popular Test Types
ForceDecks	• Countermovement Jump (CMJ) • Single Leg Jump (SLJ) • Drop Jump (DJ) • Single Limb Isometric Test • Hop Test • Hip, Knee and Ankle Run-Specific Isometric Push (Iso-Push) Tests
Nordbord	• Nordic • ISO Prone
ForceFrame	• Hip Adduction/Abduction (ADD/ABD) 60° • Hip ADD/ABD 45° • Hip ADD/ABD Supine (Ankle) • Hip ADD/ABD Seated • Ankle Plantar Flexion Tests

Who Was **Tested?**

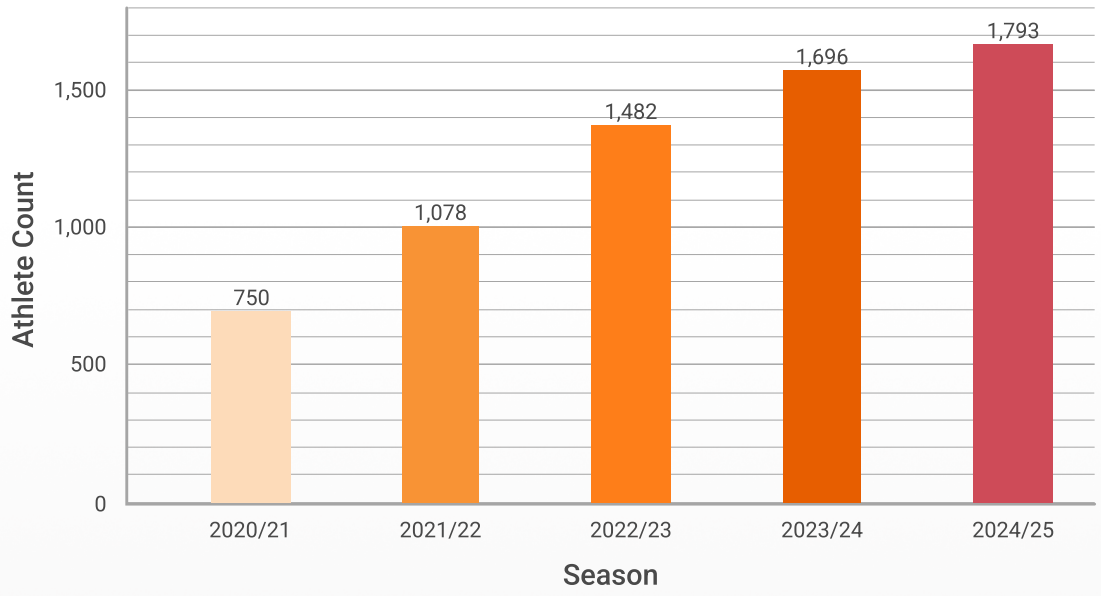
From the start of the 2020/21 season until the end of the 2024/25 season, over 11,000 individuals (based on unique profile IDs, which would include many non-Premier League athletes) were tested by Premier League clubs using VALD systems. Over this five-season period, the number of individuals tested each year has more than doubled from 2,106 in 2020/21 to 5,543 in 2024/25.

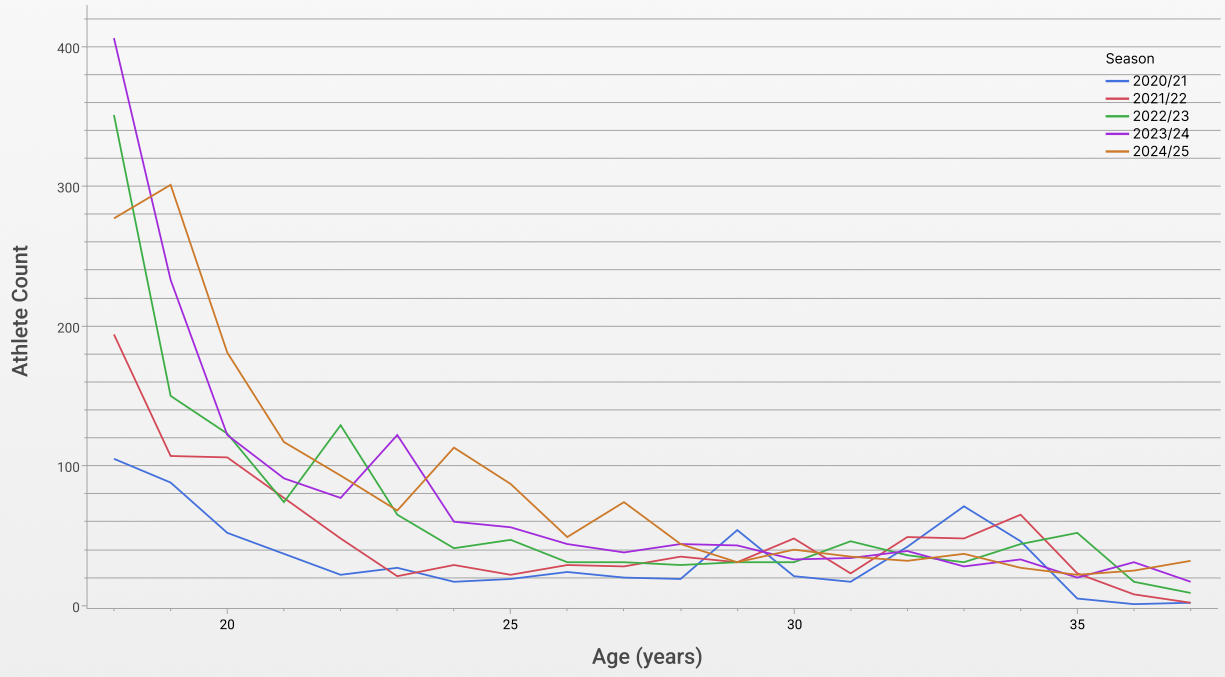
…the number of individuals tested each year has more than doubled from **2,109 in 2020/21** to **5,543 in 2024/25.**

Usage data includes all tests captured. For the purposes of the 2024/25 season report, a focused dataset – prepared via the VALD Data Lakehouse cleansing process – was used to ensure relevance to the male Premier League player population.

…1,793 male athletes aged 18–37 years were included, representing approximately 90 athletes per club (33% of the total dataset).

Note: All female athletes and individuals outside the typical professional athlete age range were excluded from the primary analysis (unless otherwise noted), to maintain consistency and applicability of insights to the Premier League's male professional cohort.





Distribution of age for male athletes tested across the five seasons. The top right shows the increase in athletes tested across seasons.

How Do I **Use** This Report?

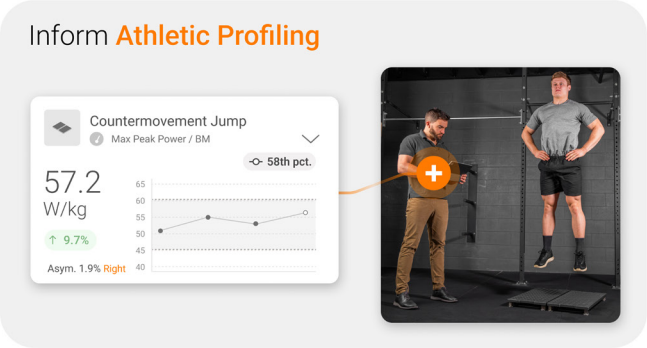
This report is intended to serve as a guide, offering valuable comparisons and insights based on data collected across the Premier League during the 2024/25 season.

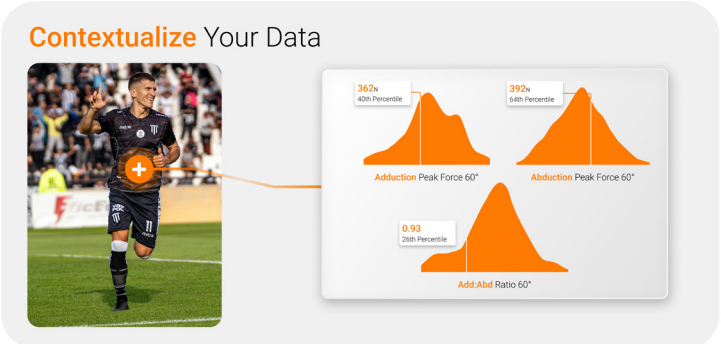
While the findings are drawn from a large, diverse and robust dataset, it is important to acknowledge that the quality and reliability of results are dependent on the accuracy and consistency of testing protocols used during data collection. Consequently, this report should not be considered a definitive standard but rather a tool to inform and support your decision-making processes.

We encourage practitioners to use this report to:

- Inform athletic profiling
- Provide context to your club's data
- Promote discussion within your team

We hope these insights help you better understand your team and athletes within the broader context of the Premier League. We look forward to continuing our collaboration to advance best practices in the application of technology to optimize performance, as well as to reduce injury risk and improve rehabilitation outcomes across the Premier League.





Testing in the Premier League **and Beyond**

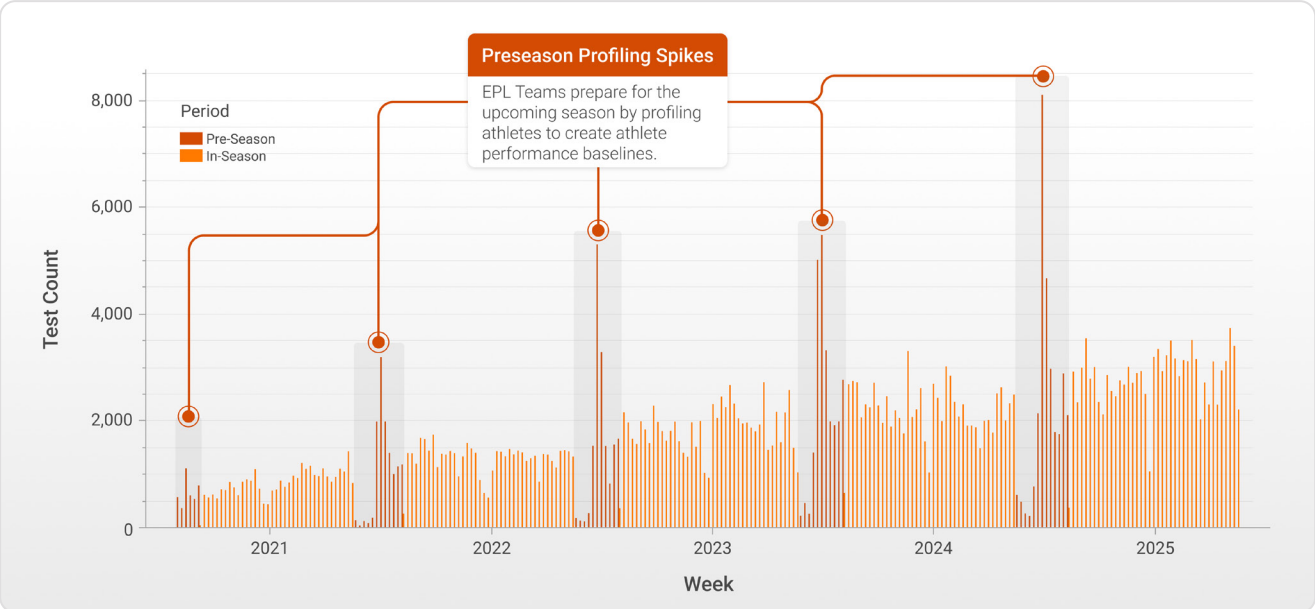
Usage trends suggest that VALD systems have become an integral part of daily operations across all Premier League clubs. The 20 clubs jointly used over 300 VALD systems to collect over 140,000 tests. However, usage extended well beyond the Premier League, deep into lower leagues and across Europe.

…104 clubs across six men's and women's English Football League competitions **used over 600 VALD systems.**

In the 2024/25 season, 104 club competitions used over 600 VALD systems, while other 36 UEFA Champions League clubs (excluding Premier League clubs) used another 150+ systems.

…collectively performing **nearly 600,000 tests in the 2024/25 season.**

89% of these clubs use ForceDecks, 81% use NordBord and 74% use ForceFrame, collectively performing nearly 600,000 tests in the 2024/25 season. An analysis of the daily number of tests conducted by Premier League clubs from the start of the 2020/21 season up until the end of the 2024/25 season reveals clear usage patterns.



VALD systems weekly usage between seasons 2020/21 and 2024/25.

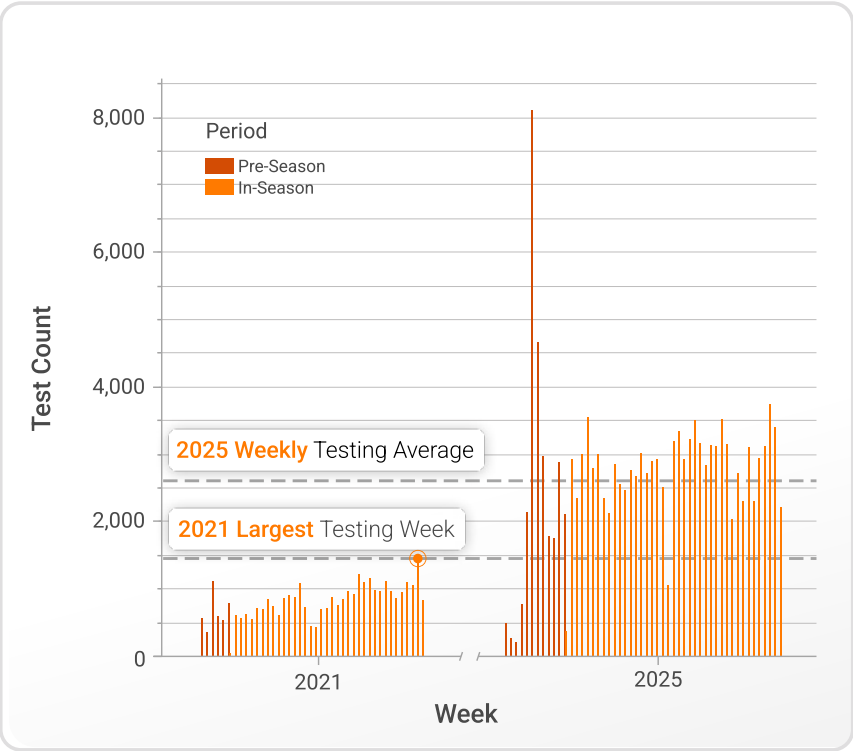
...in 2024/25, the average number of weekly tests was **approximately double the highest single week of testing in 2020/21.**

As expected, spikes in daily activity are observed during pre-season, while in-season testing activity is more consistent. These trends highlight the structured integration of objective data into athlete preparation and performance management in the Premier League.

Growth in testing volumes has also been significant, such that in 2024/25, the average number of weekly tests was approximately double the highest single week of testing in 2020/21.

...the record number of **tests conducted in one day was 2,106...**

Across the five-season period, the record number of tests conducted in one day was 2,106 on 1 July 2024 (and a record 8,107 for the week), while the longest streak of VALD system inactivity was just two consecutive days.

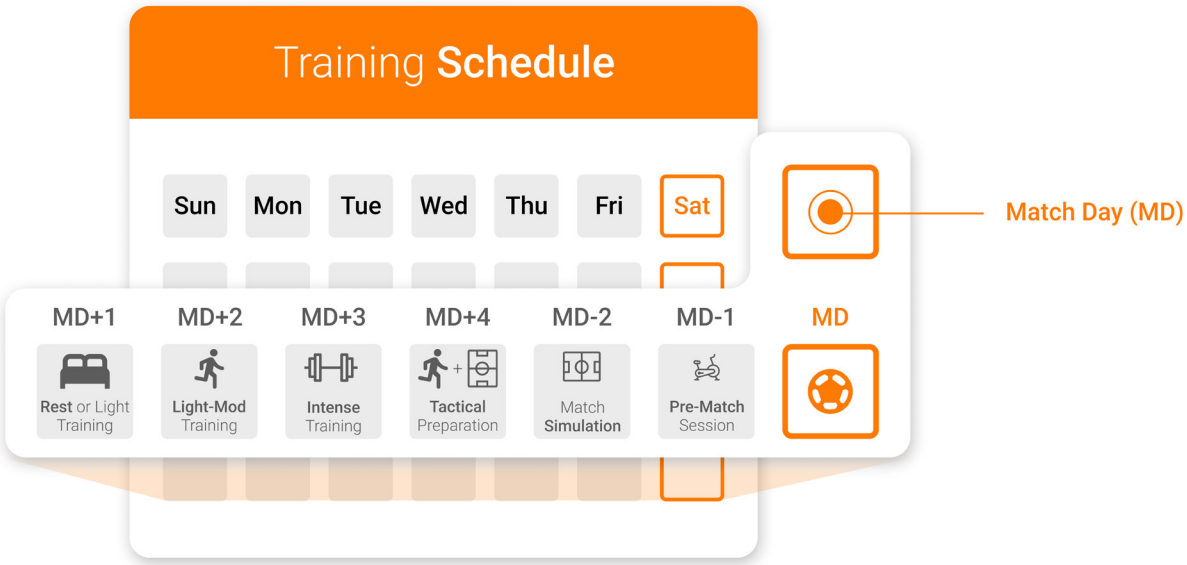


...the longest streak of VALD system **inactivity was just two consecutive days.**

Why is this important? This level of consistency highlights the scale and reliability of data being captured and stored in VALD's Data Lakehouse– the same de-identified data that now informs the insights and profiles shared in this report.

Testing **Trends**

Weekly Testing Schedule: Testing frequency by day of the week is visualized to reflect how VALD systems are integrated into the weekly training cycle. To interpret this usage, the following schedule is used as a typical week in the Premier League:



This weekly schedule assumes a Saturday match and does not account for congested periods of the season and mid-week matches.

The data included in the analyses in this report has been cleaned using metric-specific thresholds for exclusion. However, there are a number of potentially confounding factors that should also be considered when interpreting the data. These include the following:

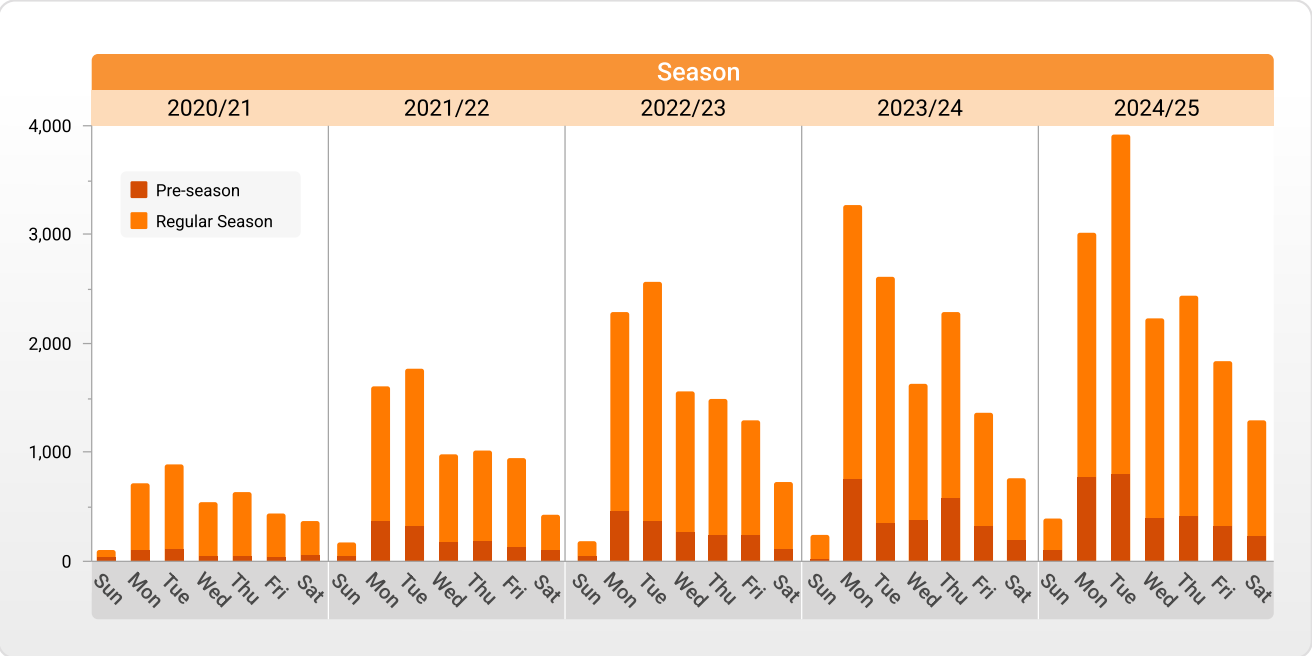
- Not all clubs or athletes performed all the tests.
- The sample will inevitably include some injured athletes' data among the predominantly healthy data.
- The sample cannot account for differences between athletes with varying amounts of match minutes, exposure to on- and off-pitch training and other load and fatigue factors.
- Tests are conducted under varied conditions and potentially with different cues.
- Inter-club differences in the scheduling of assessments (e.g., testing on MD+2 vs. MD+3) likely influence observed values on a given day.

Key Observations

Tuesday was the in-season day with the **highest number of tests.**

- **Monday and Tuesday** – corresponding to MD+2 when matches are played on Saturday or Sunday – were the in-season days with the highest volume of testing.
- **Sunday** was the lowest-usage day, consistent with match preparation and recovery priorities.
- **Saturday** testing was notably higher than Sunday, though less than any weekday.
- There has been an increase in testing on all days of the week since the 2020/21 season.

More tests were uploaded on Tuesdays during the 2024/25 season (36,941) than for the entirety of 2020/21 season (35,226).



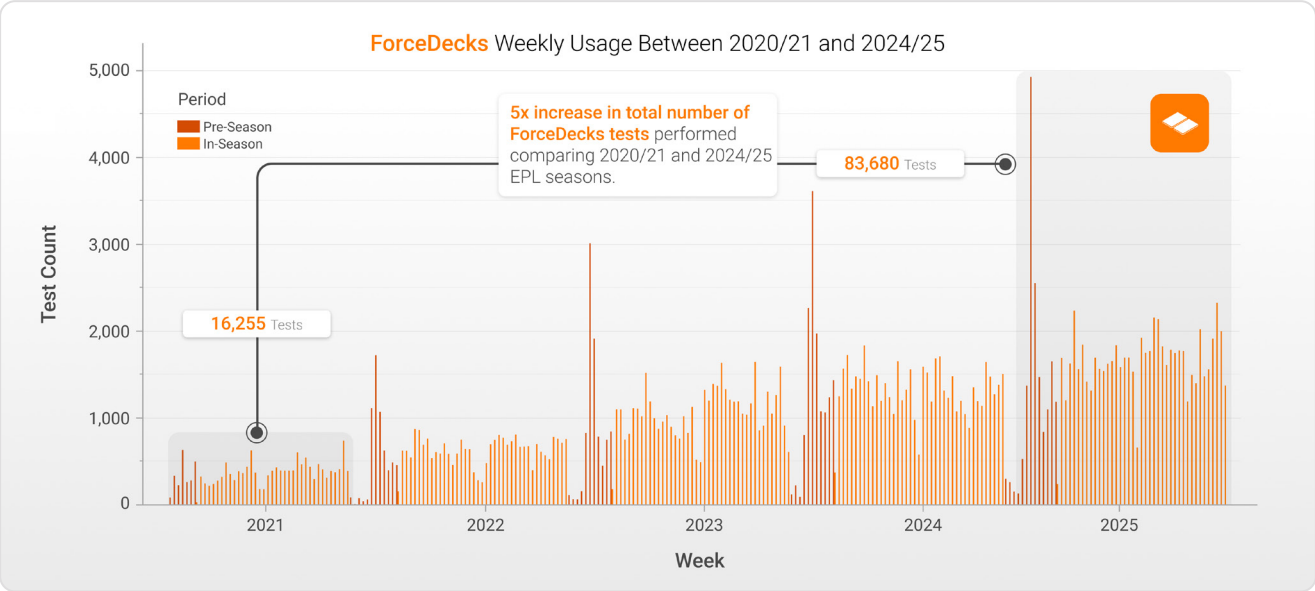
Daily patterns of testing during pre-season and in-season from season 2020/21 to 2024/25.

Usage of VALD Systems

ForceDecks were first introduced to the Premier League by inventors Dr. Daniel Cohen and Dr. Phil Graham-Smith in 2014, followed by NordBord in 2015 and ForceFrame in 2017. Since then, VALD systems have become integral to the operations of every Premier League club and are used week-in and week-out in monitoring, management and rehabilitation.

In the 2024/25 season, **a total of 83,680 ForceDecks tests** were conducted in the Premier League…a five-fold increase from 2020/21…

In the 2024/25 season, a total of 83,680 ForceDecks tests were conducted in the Premier League. This marks a five-fold increase from the 16,255 tests recorded in the 2020/21 season.



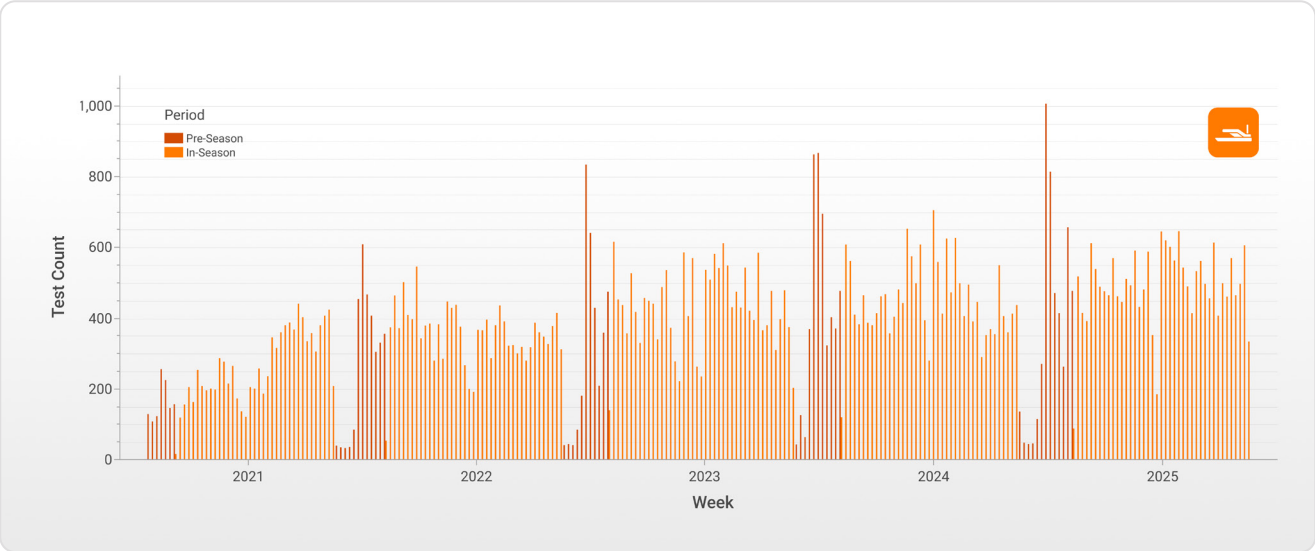
ForceDecks weekly usage between 2020/21 and 2024/25.

The NordBord – VALD's first product and the gold standard for field-based hamstring strength testing – has also become a staple of the Premier League and is now used by every club. Now in its 10th season in the Premier League, the NordBord continues to deliver insights on both performance and injury risk.

[NordBord] is now **used by every club.**

The Nordic test continues to grow in usage and remains the second most popular test of any VALD system, with a total of 17,643 tests uploaded during the 2024/25 season. The NordBord is used consistently throughout the season, with no notable activity spikes. The second most performed NordBord test is the ISO-Prone test, which has also grown in popularity since the 2020/21 season.

The Nordic test…remains the second most popular of all VALD systems, with a total of **17,643 tests…**

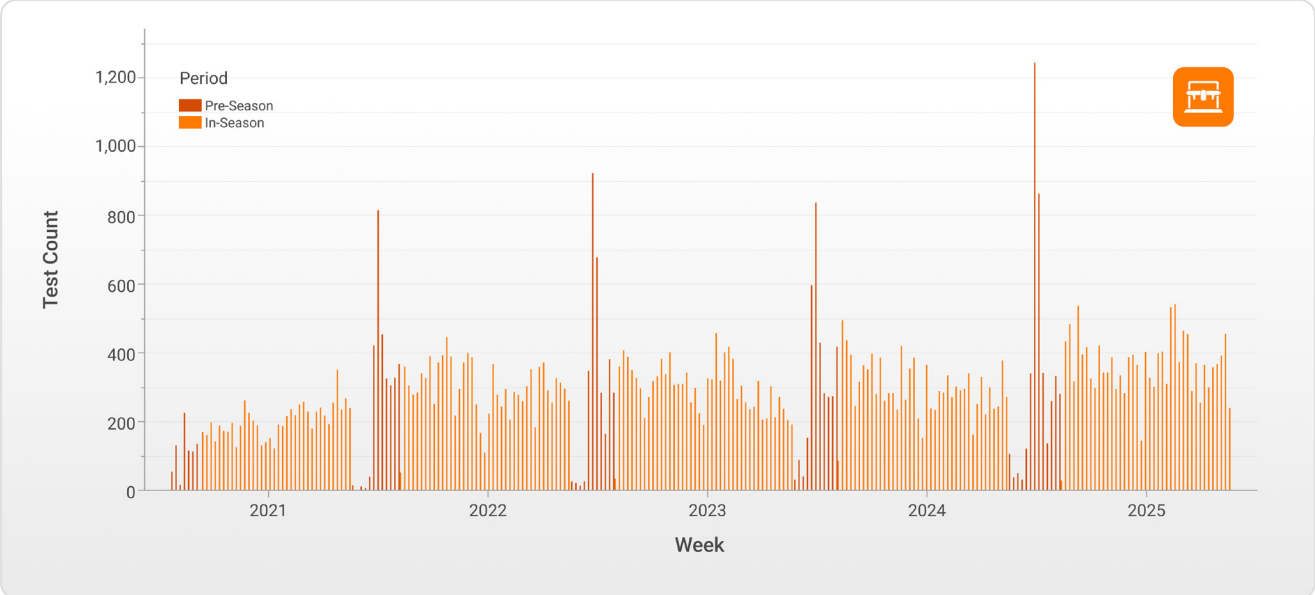


NordBord's weekly usage from season 2020/21 to 2024/25.

Originally designed for hip and groin assessments, the ForceFrame has evolved into a highly versatile system. During the 2024/25 season, it was used by 16 Premier League clubs, who conducted 61 unique test types (including custom test types), reinforcing its growing versatility.

[ForceFrame] was used for **61 unique test types…**

The pattern of ForceFrame usage across the seasons shows characteristic activity spikes during pre-season with consistent use in-season, similar to that of ForceDecks.



ForceFrame's weekly usage from the 2020/21 to the 2024/25 season.

Archetypes

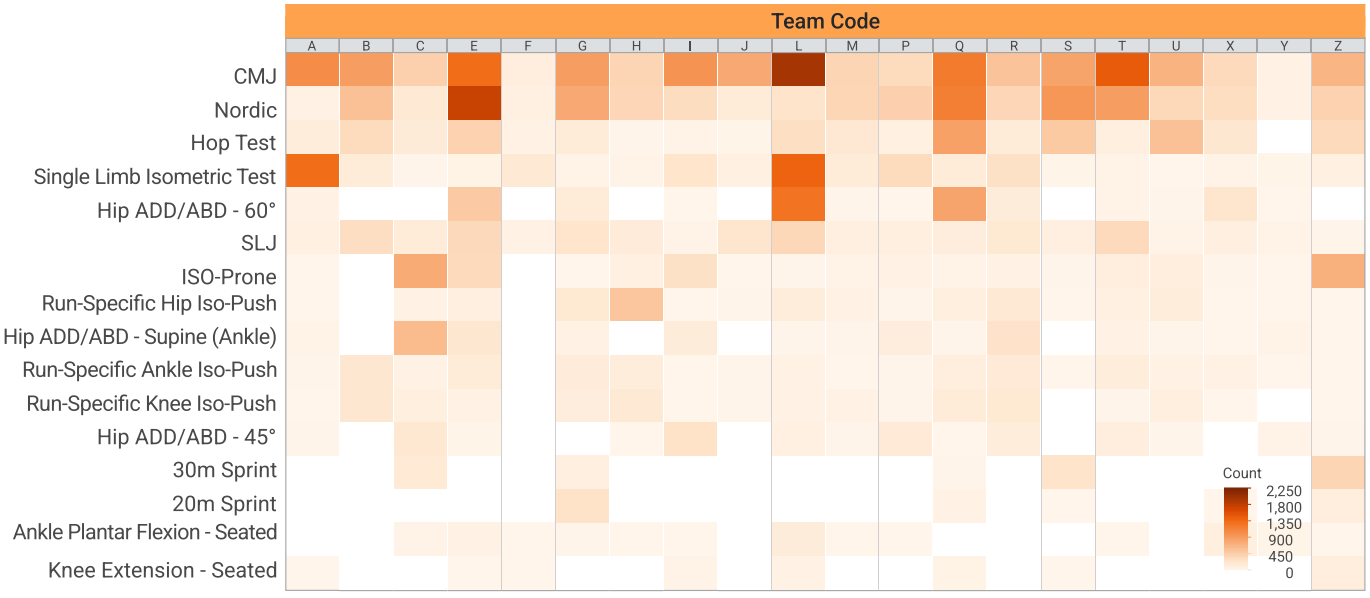
While no two Premier League athletes are identical, the sheer quantity of data collected allows us to create an indicative archetype for athletes from the 2024/25 season.

Over the following pages, we share the typical testing batteries and archetypes for athletes not only in the Premier League, but also from:

The Premier League's **Tests of Choice**

During the 2024/25 season, all Premier League teams included the following performance tests for their male population:

1. CMJ,
2. Nordic,
3. Single-limb isometric test (or Run-Specific Isometric Strength Testing) and
4. SLJ.



For the 2024/25 season, all Premier League clubs used CMJ, Nordic, single limb isometric test, SLJ and DJ.

The Premier League **Archetype**

For a full breakdown of normative data from these leagues, where norms are divided by phase of the season (pre-season and in-season). The Premier League pre-season started on 20 May 2024.

The in-season started on 16 August 2024 and ended on 25 May 2025.These values reflect the “typical” values that can be expected across pre- and in-season periods and can inform athlete profiling. Comparisons of the median values (50th percentile) for selected metrics across leagues, based on pre-season assessments alone, are presented in the European Football Archetypes.

Preseason

System	Test	Metric	Percentiles				
			5th	25th	50th	75th	95th
	Nordic	Peak Force (N)	286	380	435	488	582
		Torque (Nm)	117	156	184	212	258
	Iso Prone	Peak Force (N)	224	319	377	436	541
		Torque (Nm)	81	121	146	168	215
	Hip ADD/ABD 60°	Peak Force ADD (N)	265	369	445	507	595
		Peak Force ABD (N)	276	368	423	478	553
	Hip ADD/ABD 0° (Ankle)	Peak Force ADD (N)	137	189	223	263	324
		Peak Force ABD (N)	140	175	202	230	278
	CMJ	Jump Height (cm)	29	35	39	43	48
		FT:CT	0.61	0.73	0.81	0.90	1.05
		EPV (m/s)	-1.00	-1.30	-1.47	-1.62	-1.83
		EDRFD/BM (N/s/kg)	46	72	96	127	195
		Con Impulse - 100ms (Ns)	62	84	97	112	144
		Peak Power / BM (W/kg)	45	51	56	60	67
		Ecc Peak Power / BM (W/kg)	13	19	23	27	34
	SLJ	Jump Height (cm)	14	18	20	23	27
		FT:CT	0.38	0.47	0.55	0.62	0.75
		EPV (m/s)	-0.40	-0.70	-0.88	-1.05	-1.28
		EDRFD / BM (N/s/kg)	16	28	41	60	109
		Peak Power / BM (W/kg)	27	32	36	38	43
		Con Impulse - 100ms (Ns)	32	50	63	81	112
		Ecc Peak Power / BM (W/kg)	4.5	8	10.7	13.6	18.1
	DJ	Contact Time (s)	0.16	0.18	0.20	0.23	0.28
		Jump Height (cm)	21	30	35	40	45
		RSI (Flight Time)	1.8	2.3	2.7	3.1	3.6
	Hop Test	Mean Contact Time (s)	0.14	0.16	0.17	0.18	0.21
		Mean Jump Height (cm)	15	23	28	32	38
		Mean RSI (Flight Time)	1.9	2.5	2.8	3.1	3.5
	RSISA	Ankle Force (N)	1190	1647	1967	2331	2783
		Hip Force (N)	309	407	485	562	667
		Knee Force (N)	1844	2319	2658	3019	3470

In-Season

System	Test	Metric	Percentiles				
			5th	25th	50th	75th	95th
	Nordic	Peak Force (N)	324	409	460	518	623
		Torque (Nm)	130	166	195	225	278
	Iso Prone	Peak Force (N)	254	340	397	455	555
		Torque (Nm)	97	133	158	186	233
	Hip ADD/ABD 60°	Peak Force ADD (N)	257	361	422	490	578
		Peak Force ABD (N)	294	378	425	472	544
	Hip ADD/ABD 0° (Ankle)	Peak Force ADD (N)	121	173	217	265	351
		Peak Force ABD (N)	137	183	216	251	321
	CMJ	Jump Height (cm)	29	35	39	43	48
		FT:CT	0.61	0.74	0.82	0.91	1.05
		EPV (m/s)	-1.01	-1.31	-1.48	-1.63	-1.85
		EDRFD / BM (N/s/kg)	44	73	96	125	192
		Con Impulse - 100ms (Ns)	60	84	97	112	144
		Peak Power/BM (W/kg)	45	51	56	60	67
		Ecc Peak Power / BM (W/kg)	13	19	23	28	35
	SLJ	Jump Height (cm)	14	18	20	23	27
		FT:CT	0.38	0.48	0.55	0.63	0.76
		EPV (m/s)	-0.44	-0.74	-0.92	-1.09	-1.30
		Ecc Peak Power / BM (W/kg)	4.7	8.5	11.1	14.2	18.7
		EDRFD / BM (N/s/kg)	16	29	42	60	97
		Con Impulse - 100ms (Ns)	31	50	64	82	108
		Peak Power / BM (W/kg)	27	32	35	39	43
	DJ	Contact Time (s)	0.15	0.17	0.19	0.21	0.26
		Jump Height (cm)	19	29	35	39	44
		RSI (Flight Time)	1.9	2.5	2.9	3.2	3.7
	Hop Test	Mean Contact Time (s)	0.14	0.16	0.17	0.18	0.21
		Mean Jump Height (cm)	16	23	27	32	37
		Mean RSI (Flight Time)	1.9	2.4	2.8	3.1	3.6
	RSISA	Ankle Force (N)	1333	1716	2016	2362	2862
		Hip Force (N)	287	402	465	533	676
		Knee Force (N)	1680	2207	2602	2931	3485

Premier League vs.
UEFA Champions League

Premier League athletes – on average – demonstrated **approximately 5% higher values in specific CMJ metrics…**

When comparing pre-season jump data between Premier League and Champions League-qualified clubs, we observed small differences in specific CMJ metrics.

Premier League athletes, on average, displayed approximately 5% higher values in metrics such as eccentric deceleration rate of force development (EDRFD), concentric impulse 100ms and flight time to contraction time (FT:CT). In the SLJ test, we also noted small differences favoring the Premier League for eccentric peak power and concentric impulse at 100ms.

Overall differences in DJ performance were also small, but in contrasting directions: Premier League athletes displayed superior jump height but longer ground contact times, resulting in a lower reactive strength index (RSI).

European Football Archetypes

System	Test	Metric	Premier League	UEFA Champ	Champi-onship	League 1	League 2	WSL
			Median					
	Nordic 	Peak Force (N)	435	432	438	435	435	326
		Torque (Nm)	184	182	185	188	185	131
	Iso Prone 	Peak Force (N)	377	380	368	373	351	253
		Torque (Nm)	146	145	153	150	144	94
	Hip ADD/ABD 60° 	Peak Adductor Force (N)	445	447	444	468	–	375
		Peak Abductor Force (N)	423	432	426	444	–	344
	Hip ADD/ABD 0° (Ankle) 	Peak Adductor Force (N)	223	232	223	220	224	183
		Peak Abductor Force (N)	202	205	199	200	203	162
	CMJ 	Jump Height (cm)	39	39	38	36	36	29
		FT:CT	0.81	0.76	0.77	0.76	0.75	0.71
		EPV (m/s)	-1.47	-1.48	-1.47	-1.34	-1.36	-1.31
		EDRFD / BM (N/s/kg)	96	89	80	83	80	86
		Con Impulse - 100ms (Ns)	97	92	93	96	93	72
		Peak Power / BM (W/kg)	56	55	54	53	52	45
		Ecc Peak Power / BM (W/kg)	23	23	22	20	19	19
	SLJ 	Jump Height (cm)	20	21	21	20	20	16
		FT:CT	0.55	0.53	0.52	0.52	0.50	0.48
		EPV (m/s)	-0.88	-0.84	-0.88	-0.87	-0.78	-0.77
		EDRFD / BM (N/s/kg)	41	40	37	38	35	43
		Con Impulse - 100ms (Ns)	64	61	58	60	55	45
		Peak Power / BM (W/kg)	36	36	36	35	35	30
		Ecc Peak Power / BM (W/kg)	11	10	11	10	9	9
	DJ 	Contact Time (s)	0.20	0.18	0.20	0.20	0.21	0.19
		Jump Height (cm)	35	33	36	36	29	30
		RSI (Flight Time)	2.7	2.9	2.7	2.7	2.4	2.66
	Hop Test 	Mean Contact Time (s)	0.17	0.18	0.17	0.17	0.17	0.17
		Mean Jump Height (cm)	28	29	27	28	21	23
		Mean RSI (Flight Time)	2.8	2.8	2.8	2.8	2.4	2.7

Premier League vs.
Other English Football Leagues

Specific CMJ metrics exhibit notable differences between the Premier League and lower divisions. EDRFD is substantially higher (over 15%) in the Premier League, even when compared to the immediate division below (the Championship).

EDRFD is substantially higher **(over 15%) in the Premier League…**

For other metrics, including jump height, differences were only apparent when comparing the Premier League with League 1 and League 2 (divisions at least two levels below). Meanwhile, some metrics showed negligible differences across leagues.

Meanwhile, some metrics showed **negligible differences across leagues.**

Overall, SLJ metrics showed fewer and smaller differences between the Premier League and lower leagues than CMJ metrics. The largest differences between the Premier League and lower divisions were observed in EDRFD and concentric impulse 100ms, but patterns of superiority were not consistently unidirectional across the leagues for these or other metrics.

Premier League DJ and hop test performance was notably superior only when compared to League 2, with large differences noted in jump height and RSI.

Expert **Tip:**

The profile of CMJ metrics that differentiate Premier League performance from lower professional leagues, as revealed by this large dataset, closely aligns with findings from smaller-scale comparisons between Premier League and less elite professional leagues. Importantly, this serves as a confirmation, not only regarding the metrics identified, but also in terms of the robustness of the dataset.

Dr. Daniel Cohen
Co-founder of ForceDecks, Consultant

ForceDecks

This season, Premier League clubs conducted 47 unique ForceDecks test types, continuing to expand to include new tests outside traditional jump assessments

...Premier League clubs conducted **47 unique ForceDecks test types...**

The most used test type continues to be the CMJ, with 33,606 assessments conducted across the Premier League in the 2024/25 season.

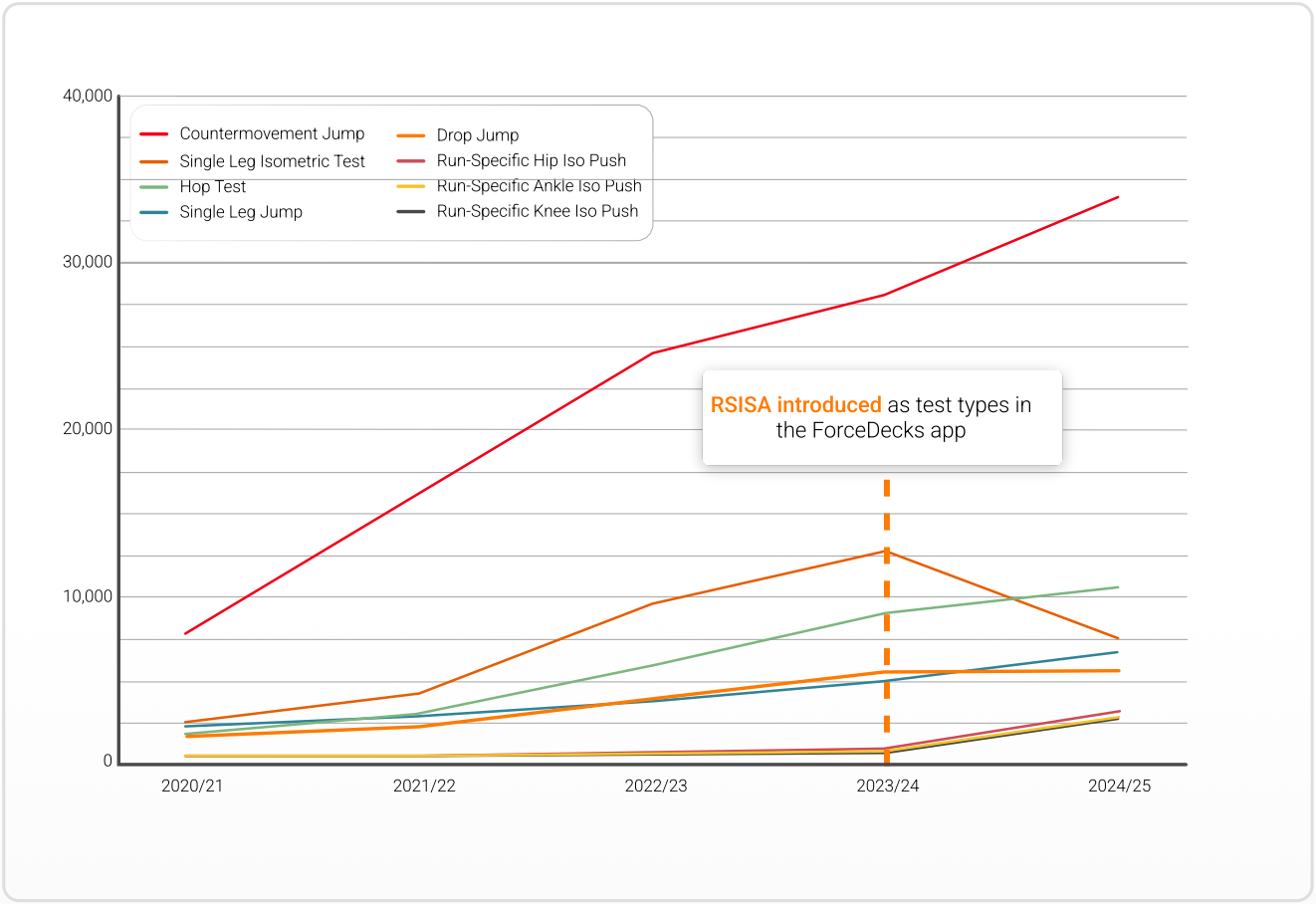
...the most used test type continues to be the **CMJ, with 33,606 tests...**

The hop test has emerged as the second most popular test in the 2024/25 season, while in parallel, DJ test usage has plateaued.

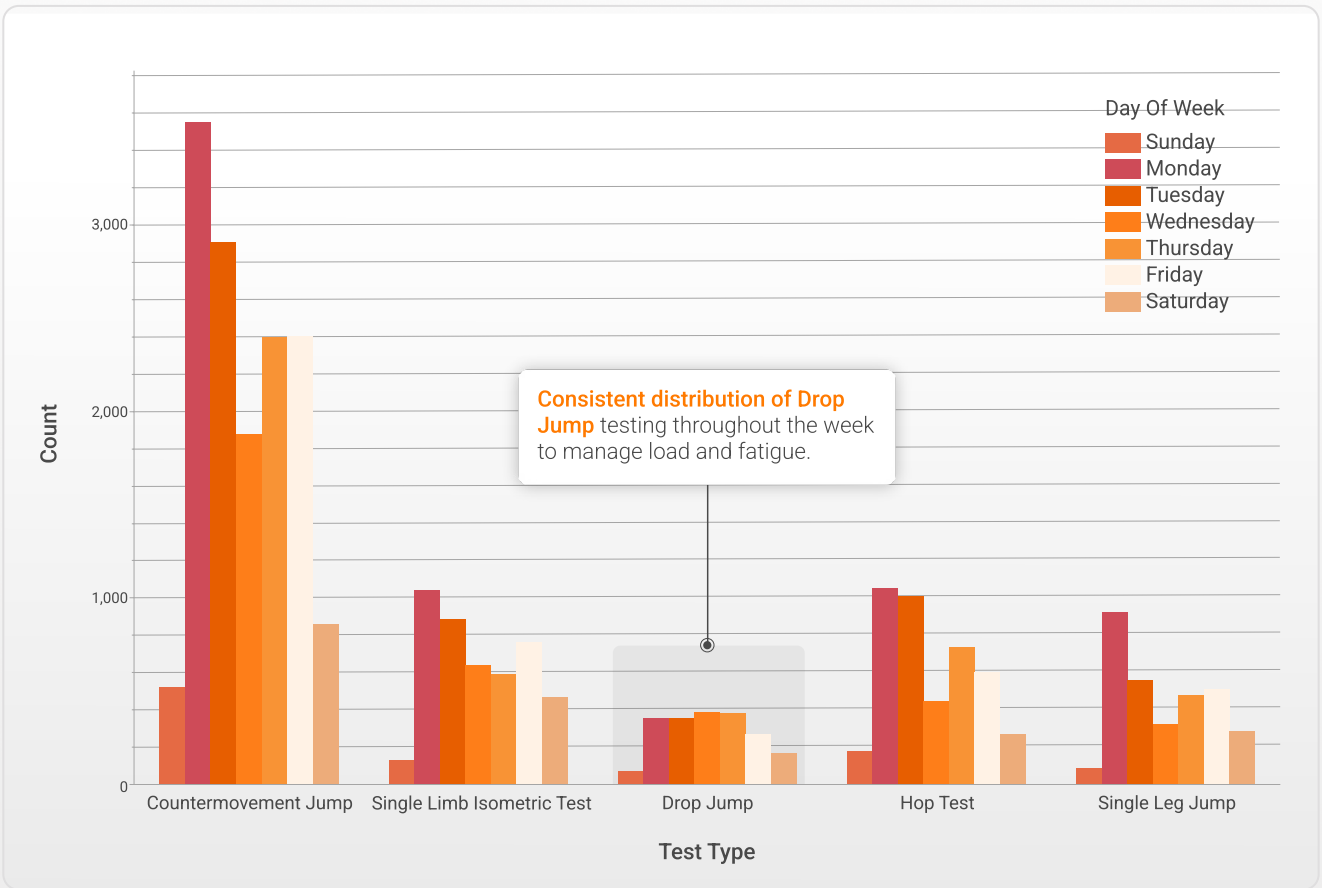
In previous seasons, the generic single limb isometric test was one of the most popular test types, as it was used for a wide range of single limb tests. However, this has now declined as single limb isometric test usage is replaced with more specific test types:

- Run-specific hip, knee and ankle Iso-Push tests
- Isometric mid-thigh pull (IMTP)
- Isometric squat variations
- Isometric push-ups
- Isometric calf raise variations
- ASH tests (isometric shoulder I, Y and T)

For the male Premier League player population, Monday was the day with the highest volume of ForceDecks testing, with the exception of the DJ, which was used consistently from Mondays to Thursdays.



The number of tests conducted for the most used ForceDecks test types by season.

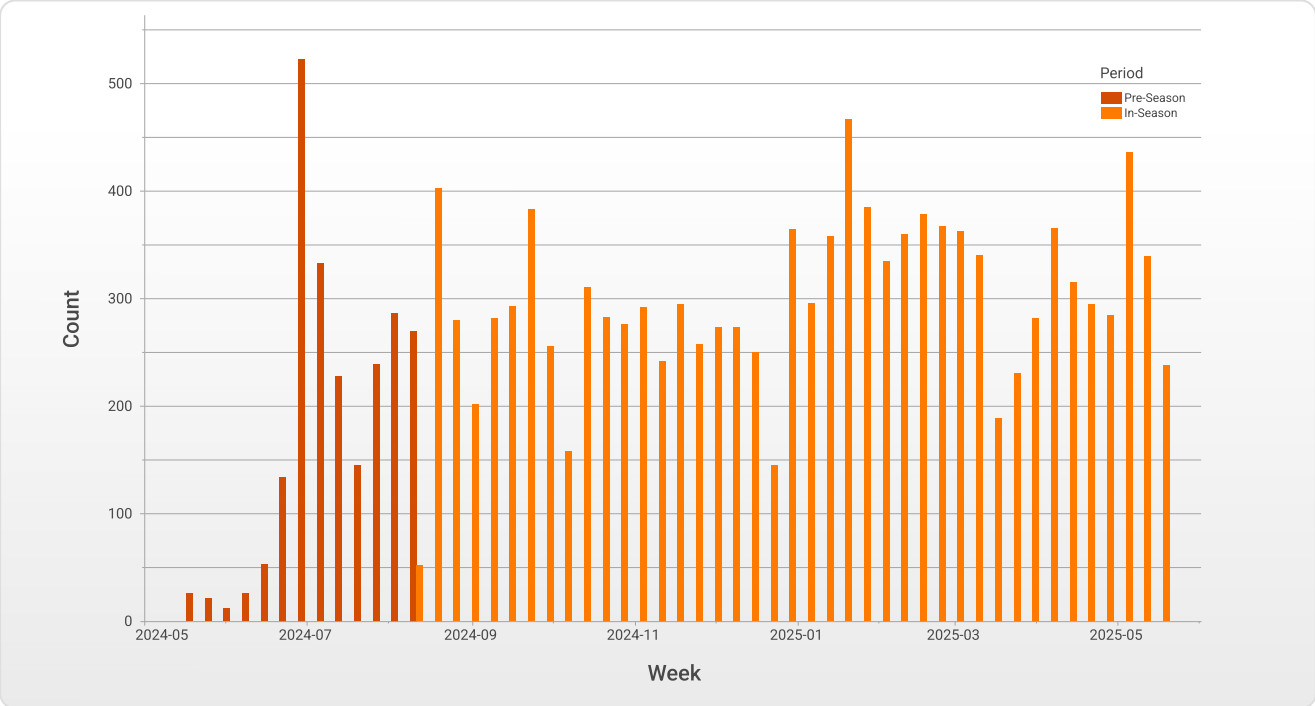


Total daily usage during the 2024/25 season for the top five ForceDecks test types.

ForceDecks **Trends**

Countermovement Jump

CMJ were consistently performed throughout the season, with a greater density of assessment observed during the early pre-season, aligning with most other performance test types.



Weekly CMJ testing volume in the 2024/25 season.

The detailed analysis in this report focuses on a limited selection of metrics. This is not meant to be a definitive list for any specific application. Rather, metric choice was based on (1) widespread use of jump height, peak power and FT:CT (or reactive strength index-modified [RSI-Mod]) and (2) value in **both** athlete profiling and load response monitoring.

As a result, duration-based metrics, primarily used for monitoring but typically not for profiling, were not included in this report.

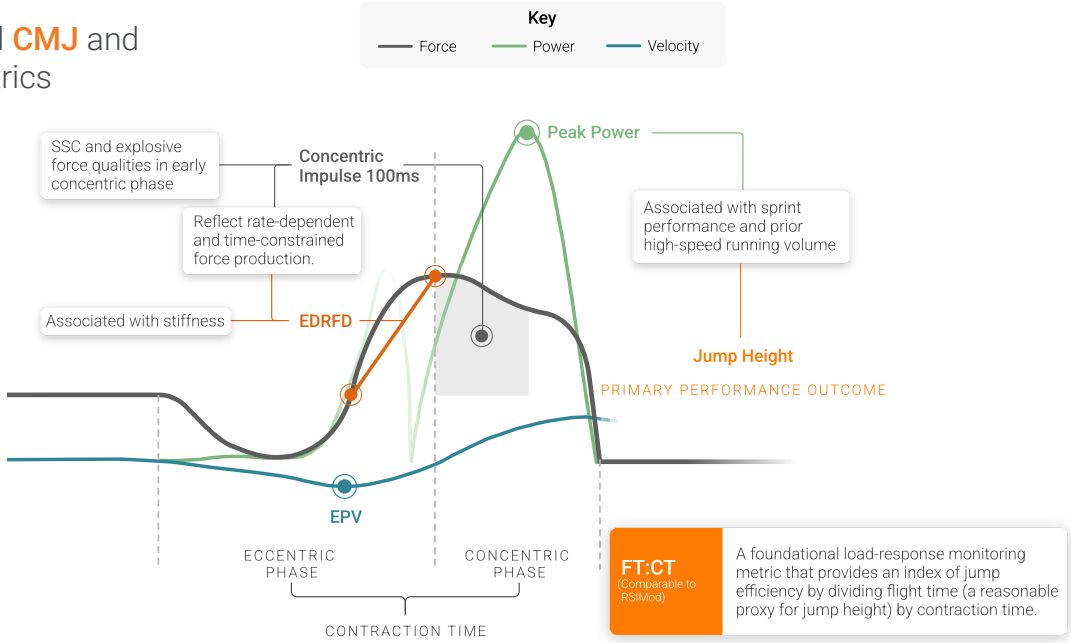
Expert **Tip:**

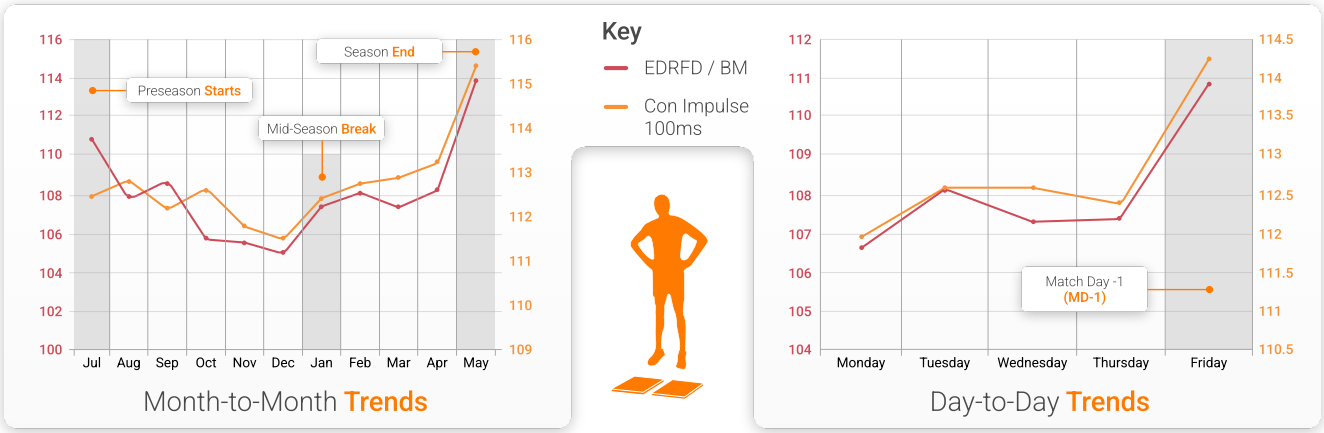
Concentric impulse 100ms and EDRFD distinguish between elite and sub-elite footballers, making them useful metrics in athlete profiling. They are also sensitive markers of short- and long-term load responses in healthy and rehabilitating athletes.

Dr. Daniel Cohen
Co-founder of ForceDecks, Consultant

These metrics are shown below:

Selected **CMJ** and **SLJ** metrics





Countermovement Jump

While there were no changes in jump height and peak power, EDRFD and concentric impulse 100ms both showed notable changes across the season and within the week. The lowest values for both metrics were seen on Monday with improvements across the week.

Conversely, the highest values were observed in May, towards the end of the season. Within the week, peak values for both metrics were seen on Friday. There was little variation in EPV across the season, suggesting consistent intent and technique.

Expert **Tip:**

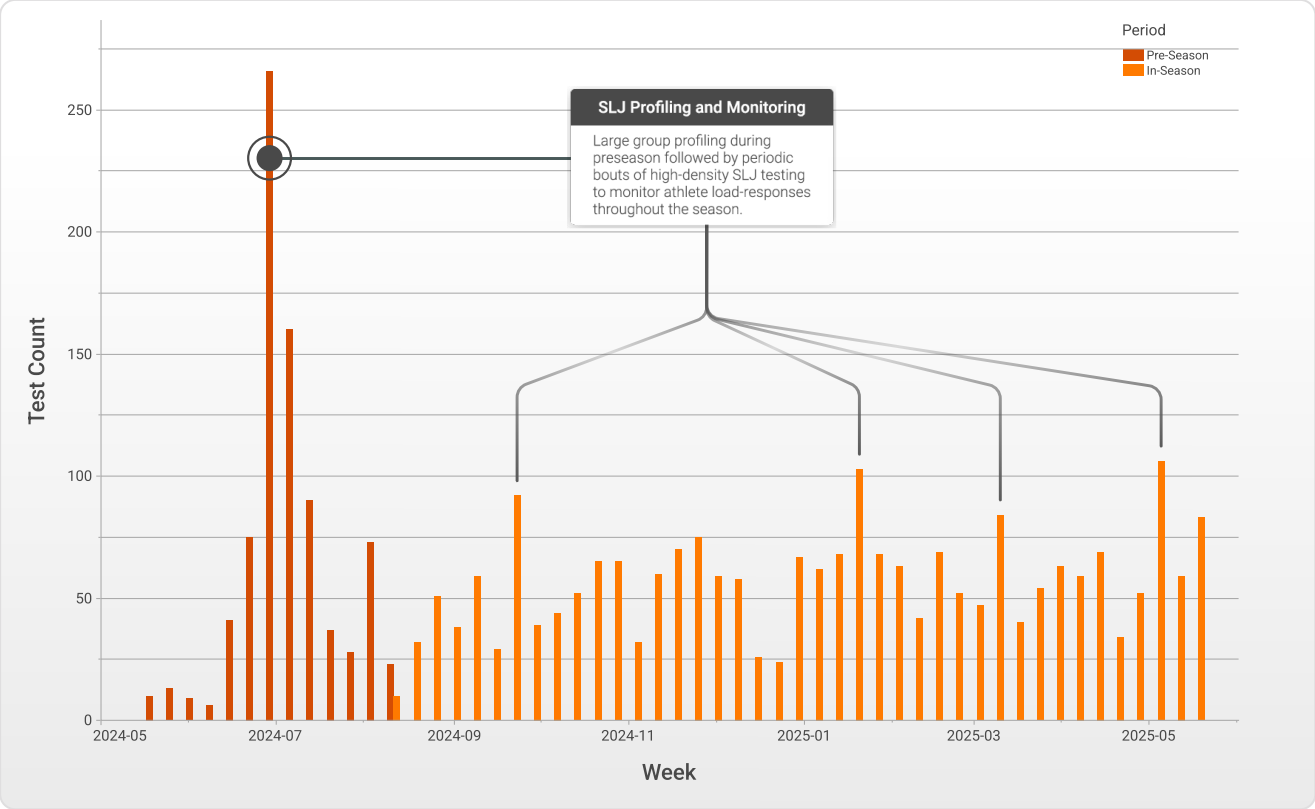
The patterns observed in EDRFD and concentric impulse 100ms across the week, and specifically The appearance of peak values for EDRFD and concentric impulse 100ms on Friday suggests that athletes are being well prepared for the weekend's competition.

Dr. Daniel Cohen
Co-founder of ForceDecks, Consultant

Single Leg Jump

Unlike the CMJ, the SLJ was used significantly more in pre-season 2024/25 than during the in-season period. This may be due to:

- Pre-season SLJ assessments being used as benchmark data in case of injury and for profiling, but
- In-season SLJ assessments being more commonly used during rehabilitation and in repeated profiling, and far less than the CMJ in routine monitoring.



The 2024/25 season's weekly usage for the SLJ test.

The same metrics were selected for SLJ as for the CMJ.

- Jump height
- FT:CT
- Eccentric peak velocity (EPV)
- EDRFD
- Concentric impulse 100ms
- Peak power

SLJ metrics displayed similar patterns to the CMJ, but all showed changes over the season.

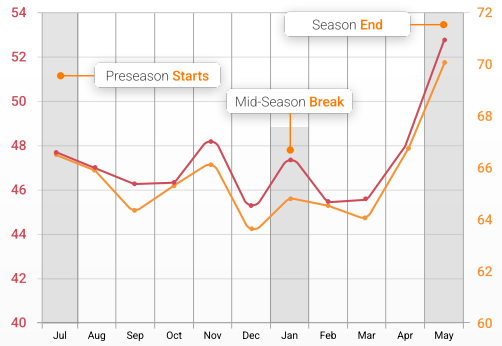
Time-constrained, rate-limited and reactive performance metrics increased over time…

Time-constrained, rate-limited and reactive performance metrics (concentric impulse 100ms, EDRFD and FT:CT) increased across the season, predominantly in the last three months. A notable decrease in these metrics was observed during December, with recovery evident in January.

Expert **Tip:**

Concentric impulse 100ms, EDRFD and EPV have principally been looked at in the CMJ. The current data highlights the potential value of considering them in SLJ analysis. For confidence in using these metrics, ensure that data hygiene processes are in place to identify and potentially remove poor trials produced by poor pre-jump stability and jump technique, often seen in the SLJ.

Dr. Daniel Cohen
Co-founder of ForceDecks, Consultant

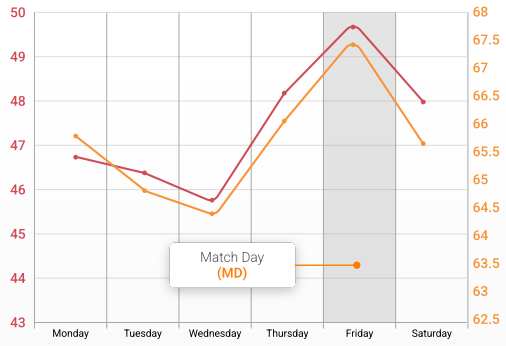


Month-to-Month **Trends**

Key

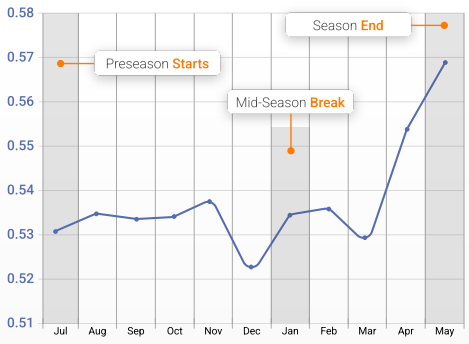
EDRFD / BM

Con Impulse 100ms



Day-to-Day **Trends**

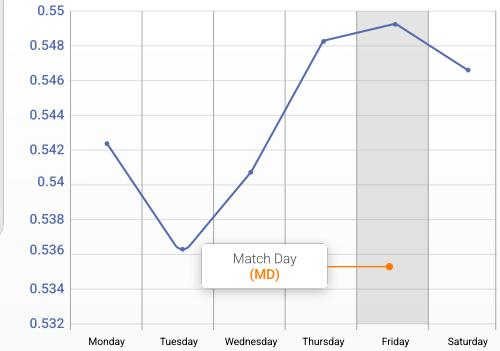
Single Leg Jump



Month-to-Month **Trends**

Key

FT:CT

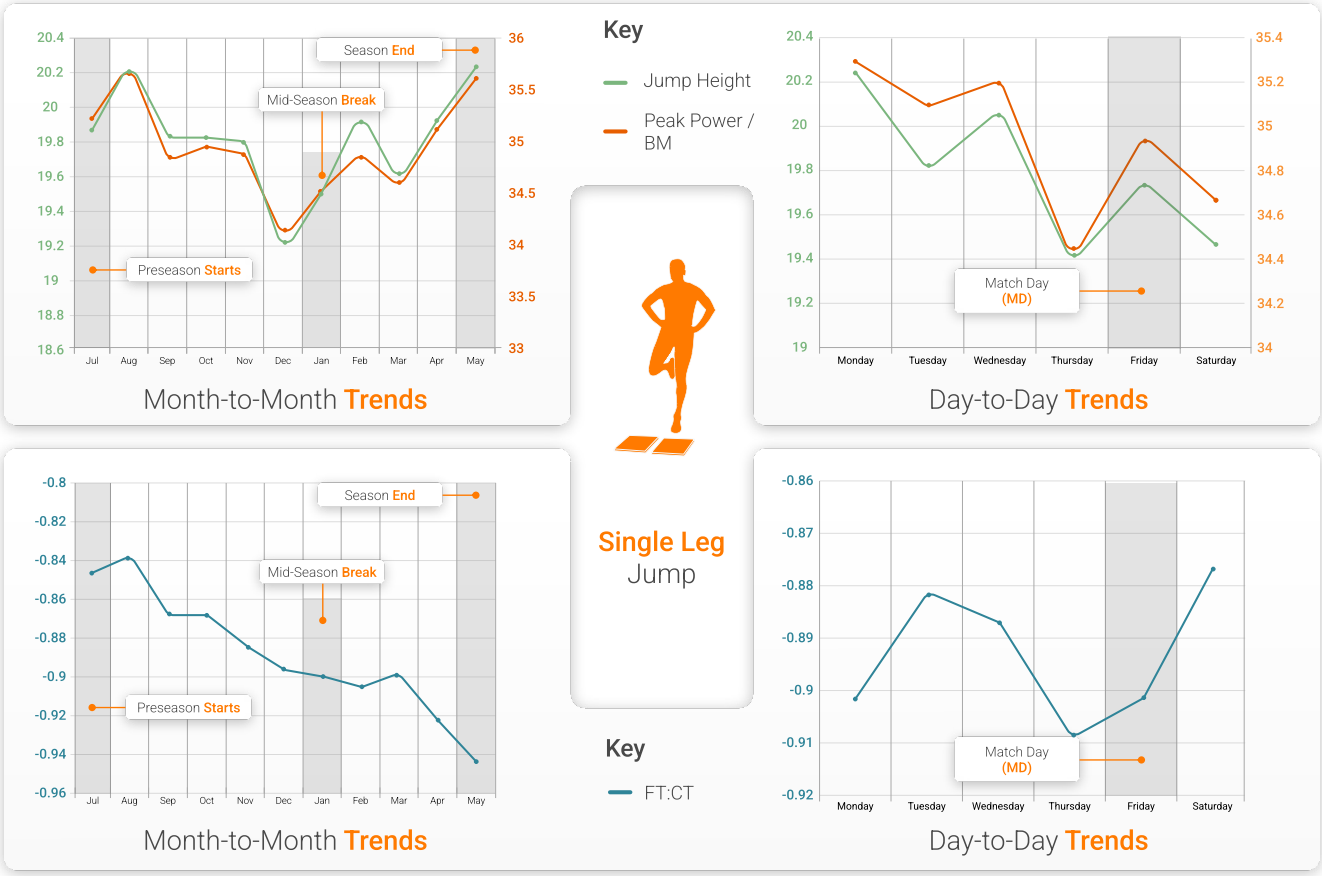


Day-to-Day **Trends**

Comparatively, jump height and peak power values showed both more pronounced decreases in December and a slower trajectory of recovery. While improvement was evident in these metrics across the final three months of the season, their end-of-season performance peak values from August.

…jump height and peak power values showed both more pronounced decreases in December and a slower trajectory of recovery.

The EPV progressively increased across the season, suggesting the SLJ was being performed with greater intent.



Considering day-to-day trends, peak performance was typically observed on Fridays, similar to the CMJ. The lowest values across the week for concentric impulse 100ms, EDRFD and FT:CT were seen on Mondays and Tuesdays, and the highest values on Fridays.

Interestingly, this pattern was reversed for jump height and power, with peak values observed in the early part of the week.

Expert **Tip:**

The divergence between jump height and time-constrained CMJ metrics in day-to-day data is consistent with evidence in elite athletes. Studies show positive associations between high-speed running volume and jump height or peak power (Thorpe et al., 2015, 2017; Morgans et al., 2018), but divergent responses in time-constrained metrics (e.g., EDRFD) 48h post repeated very high-speed running versus deceleration drills (Cohen et al., 2021). These findings suggest different CMJ metrics may be sensitive to distinct load components, reinforcing the value of a multi-metric monitoring approach to athlete monitoring.

Dr. Daniel Cohen
Co-founder of ForceDecks, Consultant

The lower values on Saturday (relative to Friday) seen in most of the SLJ metrics may be explained by a larger proportion of Saturday assessments being performed on injured or rehabilitating athletes. Saturday values might also be influenced by healthy player monitoring assessments picking up fatigue following midweek or Europa League fixtures.

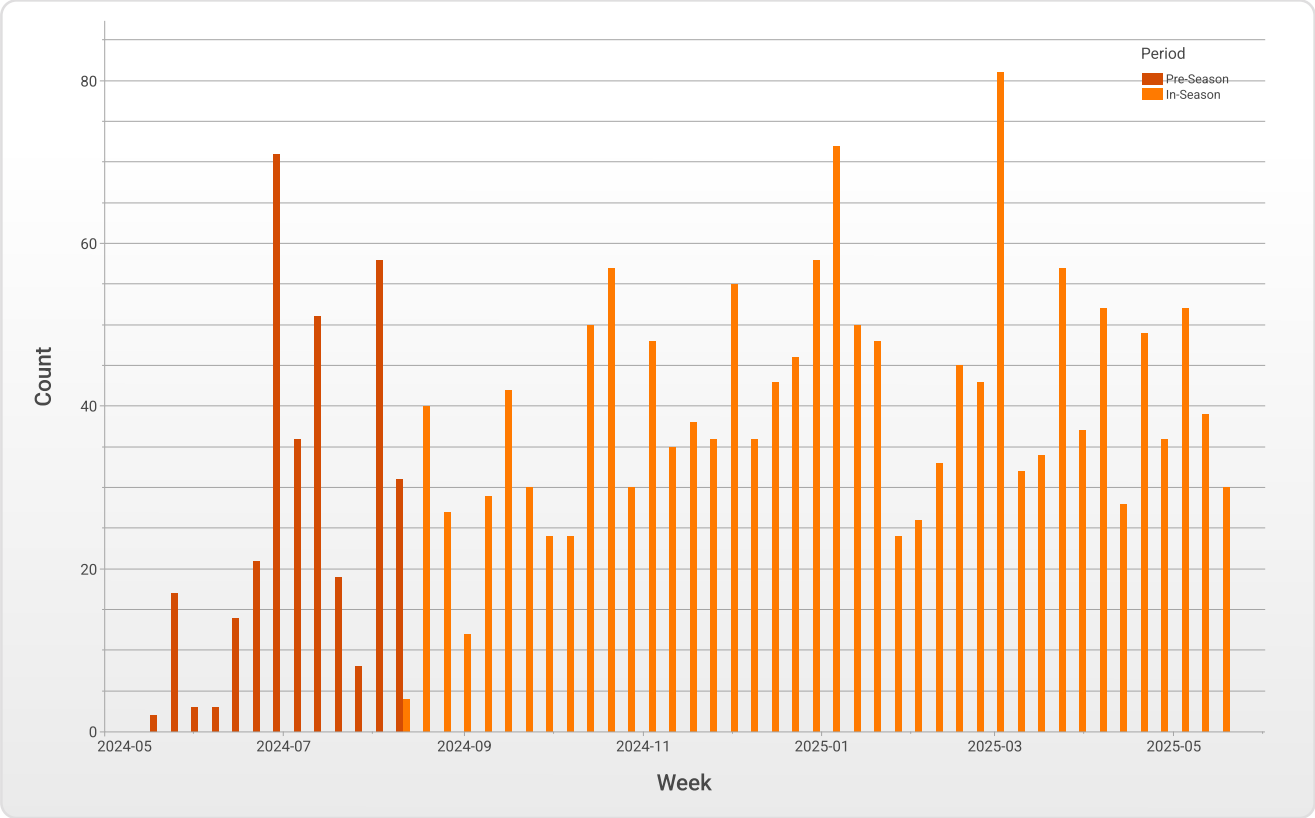
Reactive Strength Tests

The DJ and hop test are both considered reactive strength tests. While DJ analysis provides a range of kinetic metrics, trends in the performance metrics typically assessed in both tests were evaluated:

- RSI
- Jump height (or flight time in the hop test)
- Contact time

For further reading on DJ kinetics, see the Practitioner's Intermediate Guide to Force Plates and the Practitioner's Guide to ACL.

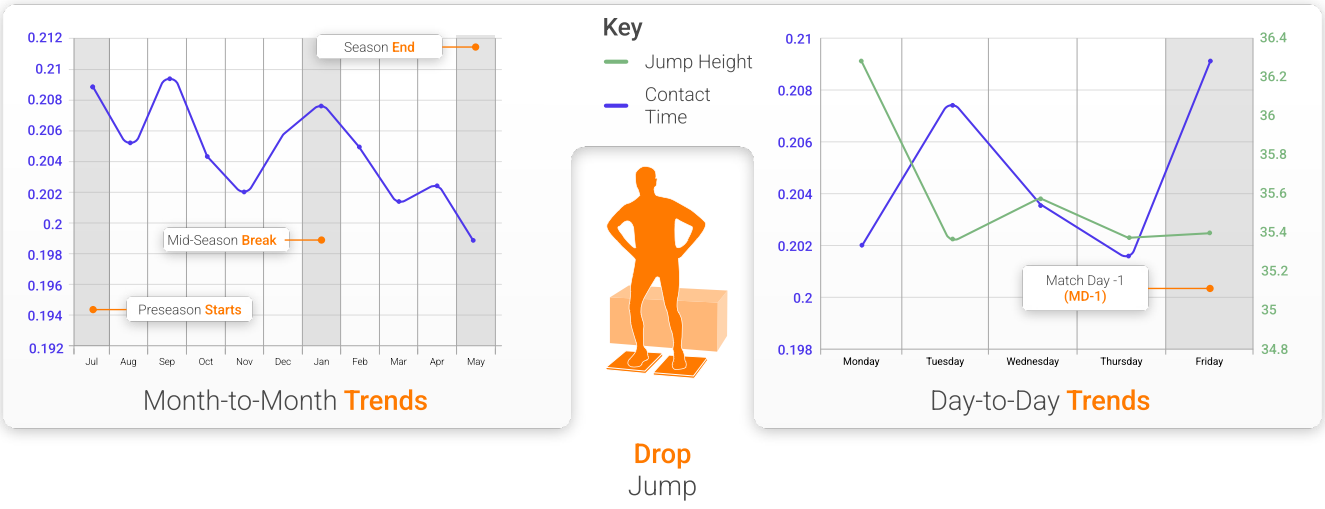
While both tests have a high volume of usage in pre-season, in-season hop test testing was consistent, suggesting use in regular monitoring. In contrast, the pattern of DJ testing appeared to fluctuate. This suggests that in-season DJ use is predominantly for periodic profiling after a training block or fixed time period and rehabilitation.



Weekly DJ testing across the 2024/25 season.

Across the season, DJ contact time decreased, while no other changes were observed in either DJ or hop test metrics.

There were day-to-day differences in the DJ, with contact time (shortest) and jump height (highest) on Monday. While this suggests suppressed stretch-shortening cycle function on Friday, sub-analysis revealed that this unexpected finding was driven entirely by a Friday “spike” in contact time during pre-season. Importantly, no day-to-day differences were evident in this metric during the in-season period.



Jump Testing Summary

The Premier League was most robustly **differentiated from lower leagues by specific CMJ metrics.**

Across the 2024/25 season, similar performance patterns were evident for the CMJ and SLJ, with the latter showing changes not only in time-constrained metrics but also in jump height and peak power.

…significantly lower DJ contact time…demonstrates **improved neuromuscular performance toward the end of season…**

The consistent late-season peaks observed across time-constrained CMJ, SLJ as well as DJ performance metrics enhance confidence in the validity and practical significance of these patterns. Progressive decreases across the season and significantly lower DJ contact time align with the CMJ and SLJ trends and collectively demonstrate improved neuromuscular performance toward the end of the season.

Expert **Tip:**

The emergence of peak eccentric deceleration RFD and concentric impulse 100 values at the end of the season might seem counterintuitive when load-response monitoring is viewed through a fatigue-centric lens. However, these trends align with observations in elite basketball, and in Rugby 7´s (Lonergan et al., 2022), in that at the group level, elite athletes not only cope with the demands of training and competition but actually exhibit positive adaptations in specific neuromuscular qualities.

Dr. Daniel Cohen
Co-founder of ForceDecks, Consultant

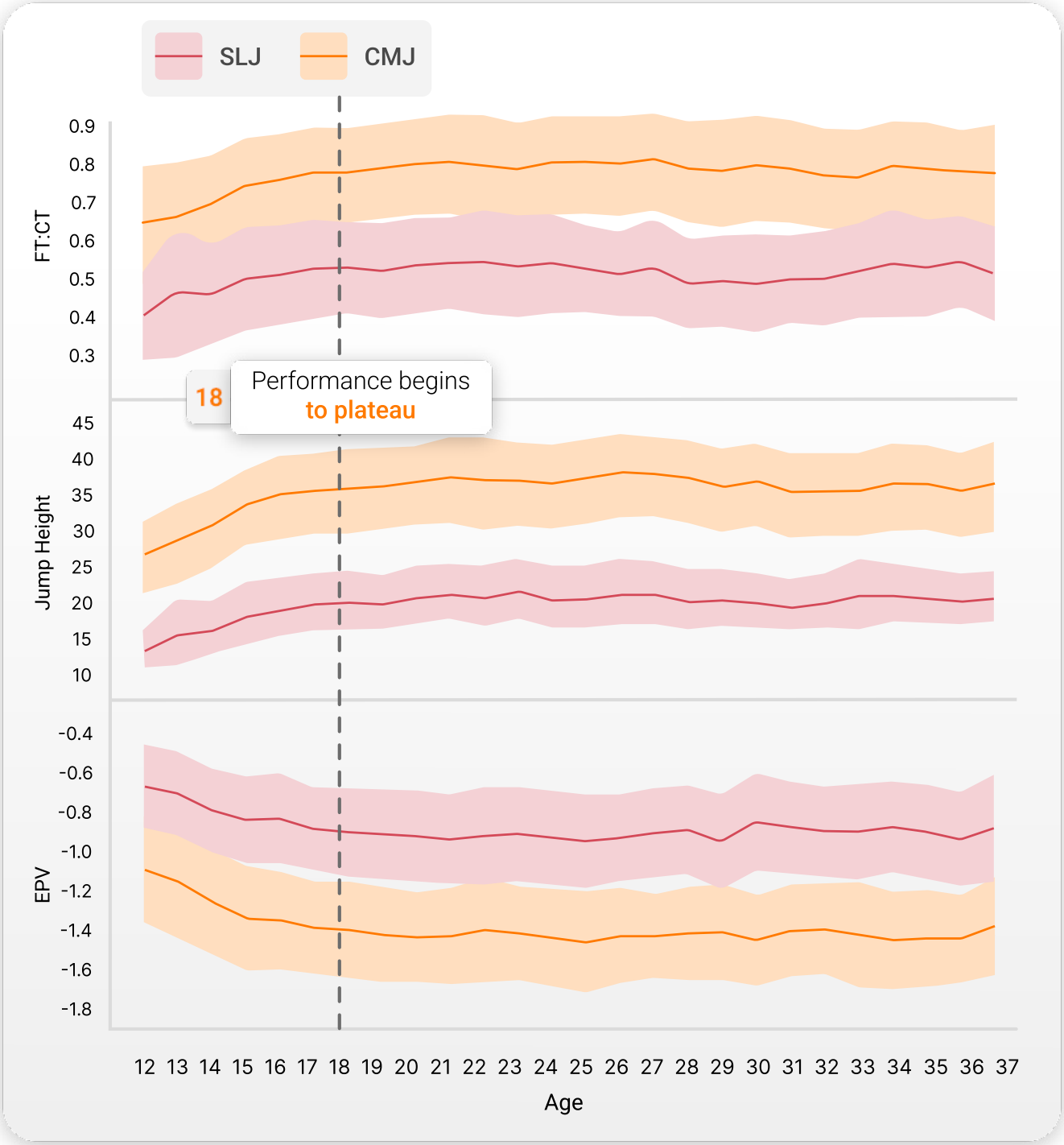
…elite athletes not only **cope with demands** of training and competition but also **exhibit positive adaptations…**

They show enhanced reactive, stretch-shortening cycle qualities as the season progresses, represented by these metrics (amongst others) despite the accumulation of games and potential perception of fatigue.

Lack of cross-season change for hop test metrics alongside the improved DJ contact time suggests that these are not interchangeable in terms of capturing chronic load response.

Jump Performance Across Age Groups

CMJ and SLJ jump height, FT:CT and EPV for Premier League Club athletes aged from 12 years of age are shown below. This novel data provides additional context to values obtained for these metrics when profiling athletes of different ages. Importantly, at 18 years of age, jump height and EPV values appear to typically stabilize. The age differences observed should be considered when defining a target EPV.



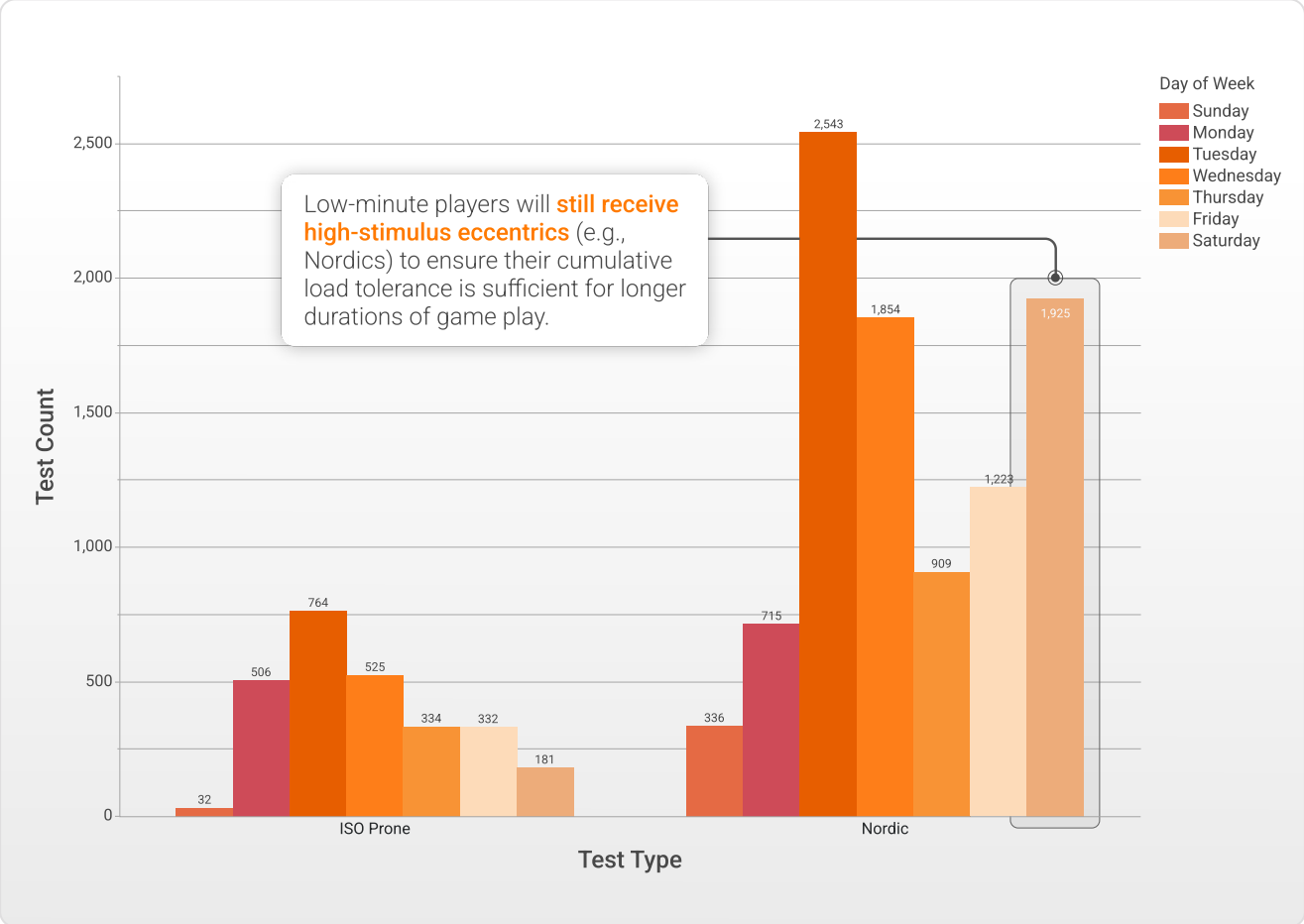
For more on the practical application of EPV, read Dr. Morgan Williams and Dr. Daniel Cohen's full blog on The Power of EPV.

NordBord

The greatest number of Nordic tests were performed by the male Premier League player population on Tuesday, followed closely by Wednesday and then Saturday.

Interestingly, unlike other test types, the high use of Nordics on Saturdays (i.e., commonly MD) suggests a possible strategy to inject an eccentric stimulus post-match. This may be targeted at athletes who did not play or those undergoing rehabilitation programs, taking advantage of the typical recovery day on Sunday.

…the high use of Nordics on Saturdays (MD) suggests a possible strategy to **inject an eccentric stimulus post-match** or for those who did not play…



2024/25 daily testing schedule for the most popular NordBord test types.

NordBord **Trends**

From the outset of pre-season, both peak Nordic force and asymmetry increased, with the highest forces typically observed at the end of the season. This trend may suggest a slight suppression of strength in the weaker limb.

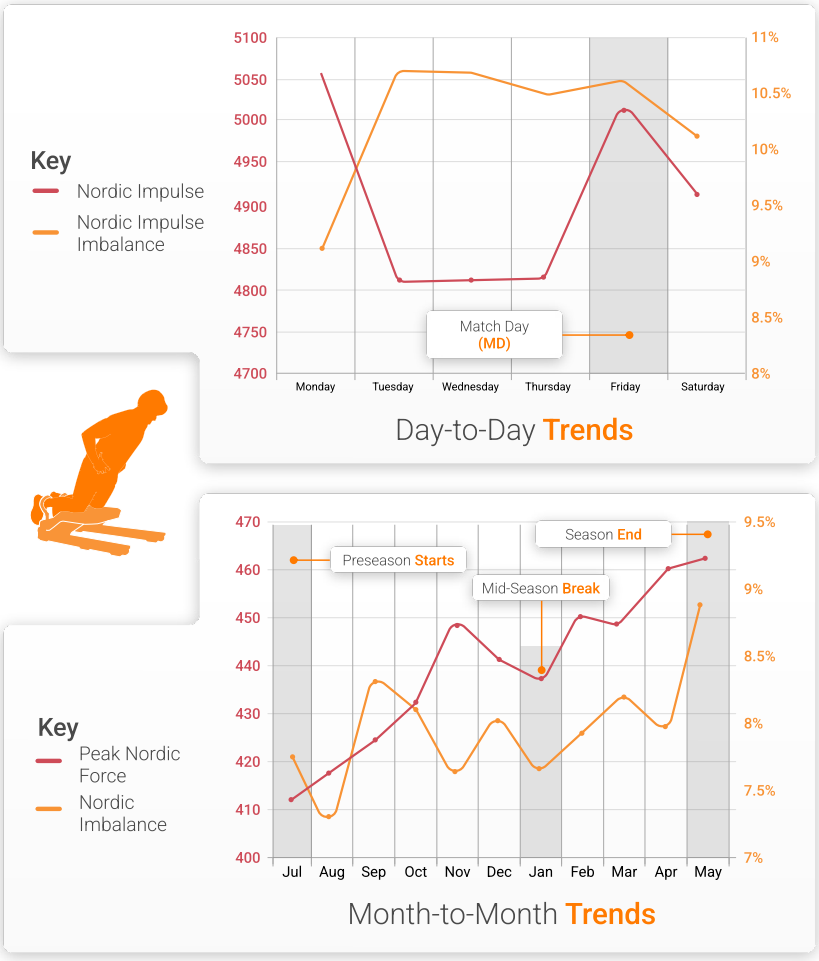
Beyond peak force, the impulse captured during the Nordic test can provide additional insight into how the exercise is performed. Daily trends in Nordic impulse and impulse imbalance suggest differences in movement execution over time.

Keeping one eye on peak Nordic force and one on impulse may provide insight into how well the Nordic test is being performed.

Notably, performance on Mondays suggests better quality of execution, compared to Tuesday through to Thursday where the lower impulse and slight increase in imbalance suggest the weaker leg contributes less to the whole movement. Fridays, and to a lesser extent Saturdays, suggest better execution yet an imbalanced limb contribution.

Keeping one eye on peak Nordic force and one on impulse may provide insight into how well the Nordic test is being performed.

Nordic
Hamstring Curl



Normalizing Nordics to **Body Mass**

During the Nordic test, an athlete's body mass serves as the external load, so heavier individuals might be expected to generate greater forces than lighter athletes. While professional footballers tend to be a relatively homogeneous group compared to other cohorts (e.g., Rugby Union athletes), variations in body mass could still affect force output.

If raw Nordic force values are influenced by body mass, comparisons between athletes may be misleading. This raises an important and commonly asked question: How should peak Nordic force be normalized?

…how should peak Nordic force be **normalized?**

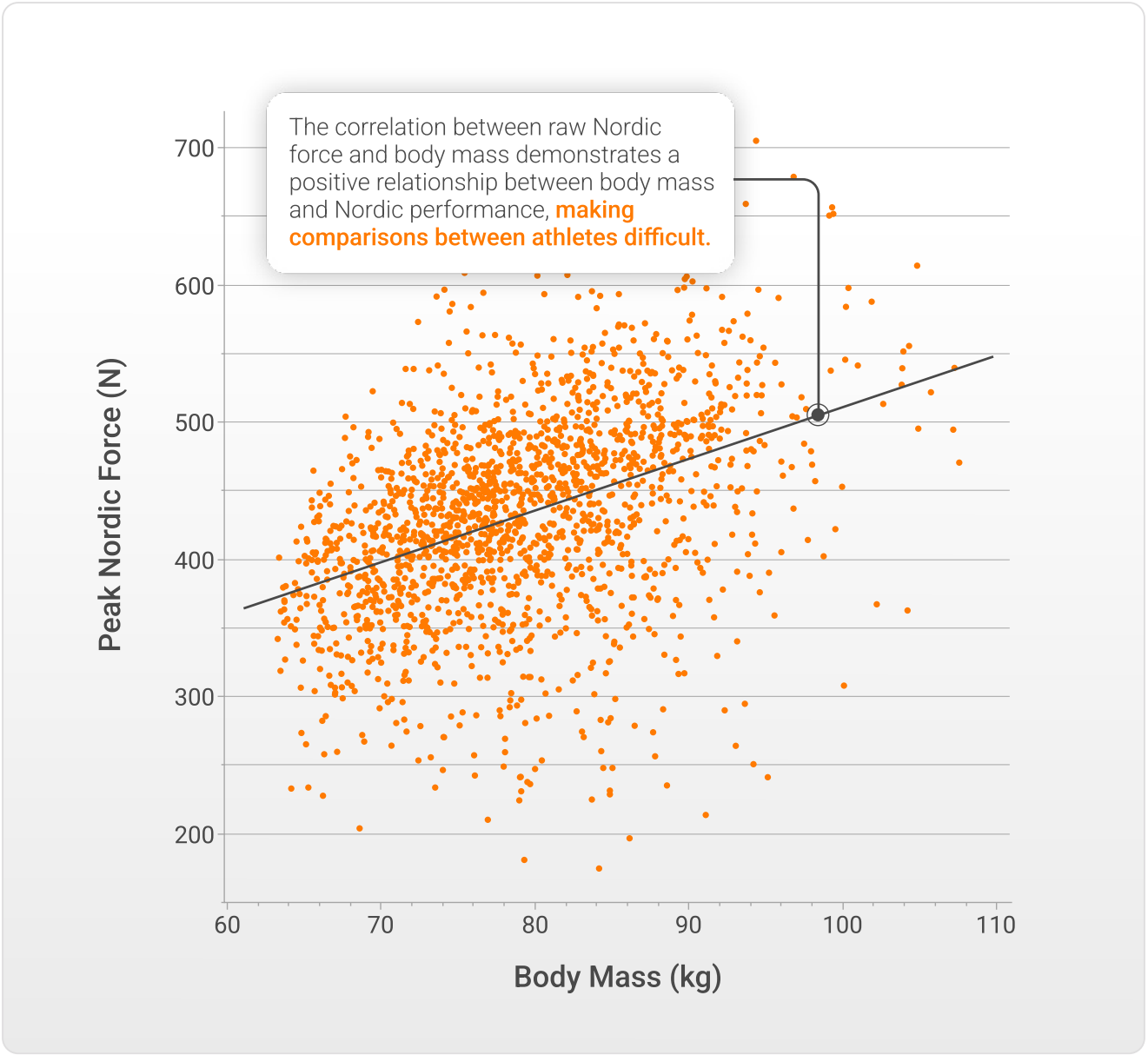
To answer this question, a dataset of 3,505 male footballers from around the world was extracted from the VALD Data Lakehouse. All athletes had completed a Nordic test and had body mass data recorded via ForceDecks.

…the VALD Data Lakehouse …allows us to explore a dataset comprising **3,505 male footballers from around the world with recorded Nordic tests and body mass data…**

The dataset was split into two groups, with a third group drawn from this season's Premier League cohort:

	Sample Size	Age (Years) Median and Range	Body Mass (kg)	Peak Nordic Force (N)
Training Dataset	1,762	23 (18-37)	79.1 ± 8.1	432 ± 76
Validation Dataset	1,743	23 (18-37)	79.4 ± 8.4	430 ± 73
Premier League 2024/25	196	21 (18-37)	79.5 ± 10.2	436 ± 72

Raw Nordic force values were influenced by body mass, making comparisons between athletes misleading.

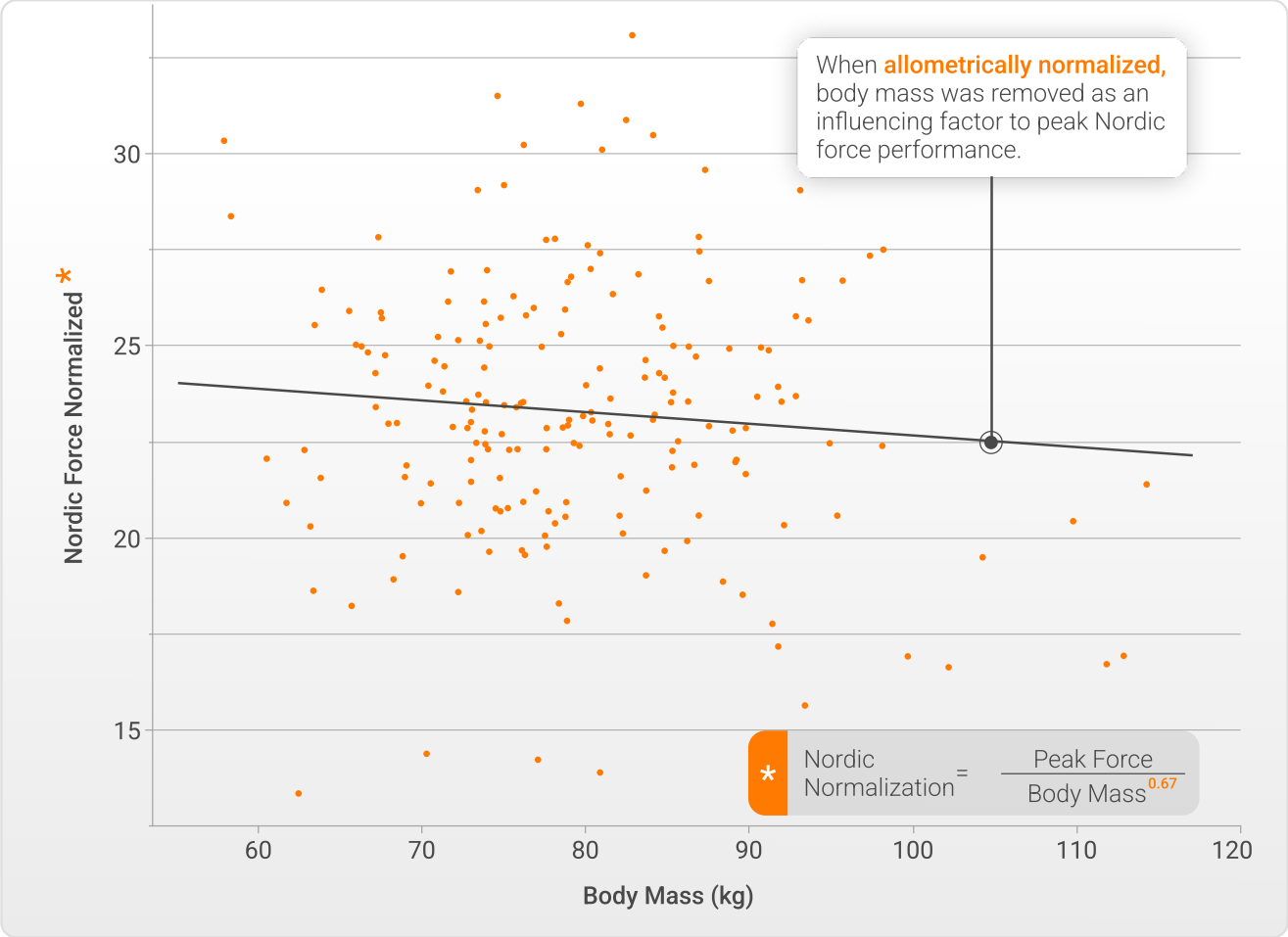


Body mass relative to peak Nordic force.

Simple ratio scaling (force ÷ mass) using the training dataset reduced but did not eliminate this bias. Allometric scaling using body mass$^{0.67}$ – based on dimensional theory and specifically fitted exponent – removed body mass as a factor (R^2 = 0.00). Validation across the 1,743 male footballers (from the VALD Data Lakehouse) and the Premier League cohort confirmed this approach.

...scaling exponent of body mass$^{0.67}$ **effectively removes the influence of body mass on peak Nordic force.**

Using the theoretical exponent of body mass$^{0.67}$ proposed in the literature to normalize peak Nordic force for the Premier League cohort eliminated the impact of body mass.



Nordic vs. Isometric Hamstring Strength

Muscles are capable of generating significantly higher forces during eccentric compared to isometric or concentric muscle actions. As a consequence, most athletes should produce higher forces during the eccentric Nordic test than during the ISO-Prone test.

However, when ISO-Prone forces exceed Nordic forces – as observed for some Premier League athletes – it may indicate a need for closer evaluation.

…when ISO-Prone forces exceed Nordic forces…it may **indicate a need for closer evaluation.**

There are many reasons that this might occur. For example:

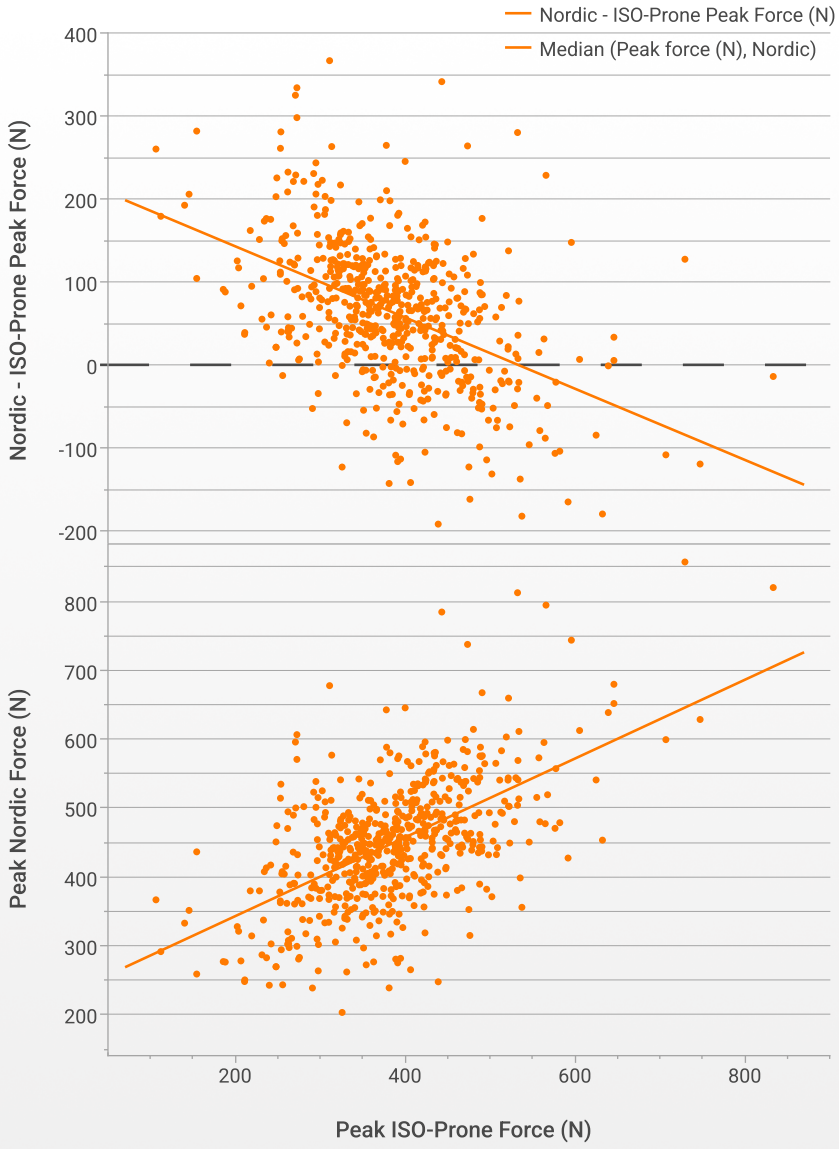
- The Nordic test was performed poorly, without intent or the athlete was unfamiliar with the test procedures.
- The athlete has underpinning issues causing weakness that need attention (e.g., neural inhibition or delayed onset muscle soreness).
- The Nordic test was too easy and may have required additional load (i.e., body mass was insufficient to make the exercise "supramaximal").

For a more detailed discussion on the benefits of comparing the two NordBord tests to enhance practice, read Dr. Morgan Williams' full blog on Nordic testing and new applications for training, monitoring and evaluation.

NordBord Testing

New applications for training, monitoring and evaluation

View Blog here



The relationships between ISO-Prone peak force and peak Nordic force (bottom), and the difference between Nordic and ISO-Prone peak forces (top).

Nordic vs. **Isometric Knee Extension Strength**

The relationship between seated knee extension force and Nordic force provides a field-friendly indication of the hamstring-to-quadriceps (or “H:Q”) strength ratio – commonly used in performance and injury screening assessments.

If you are assessing an athlete for the first time, the relationship may be useful to practitioners, especially in the rehab and return-to-performance context.

o support interpretation, the quadrant chart below may be used as a guide to identify athletes who have potential imbalances or who deviate from normative data provided in the Premier League Archetype and European Football Archetypes of this report.

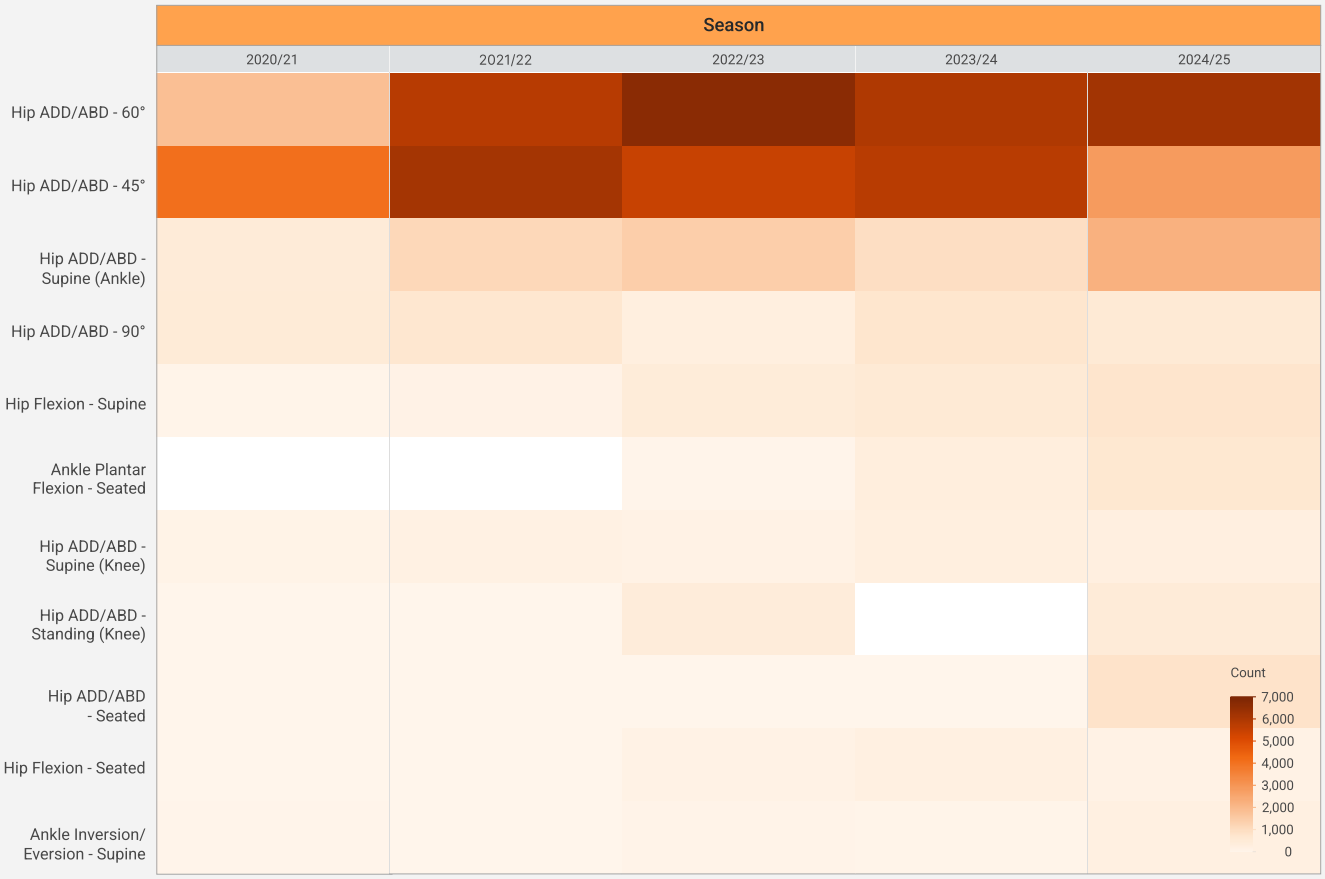
Isometric quadriceps strength compared with eccentric hamstring strength.

ForceFrame

ForceFrame remains the go-to testing system for isometric hip and groin strength assessments. The most popular tests were:

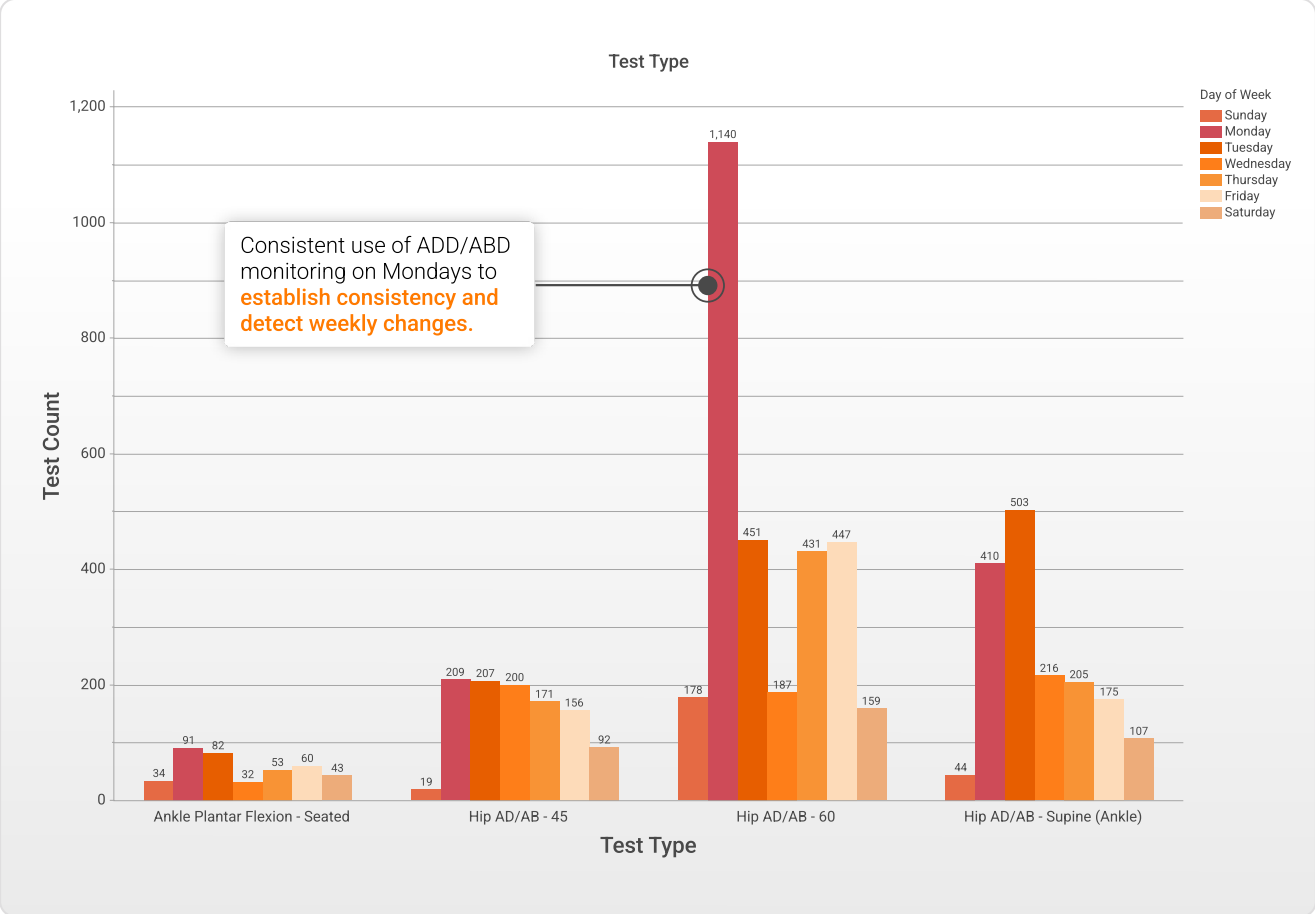
- Hip ADD/ABD 60° with 6,315 tests
- Hip ADD/ABD 45° with 2,927 tests
- Hip ADD/ABD supine with 2,293 tests

Outside of hip tests, the next most popular ForceFrame test type was ankle plantar flexion (seated).



The top 11 ForceFrame test types by season.

For the male Premier League player population, Monday was – by far – the day with the highest amount of ForceFrame testing, most notably for hip ADD/ABD assessments.



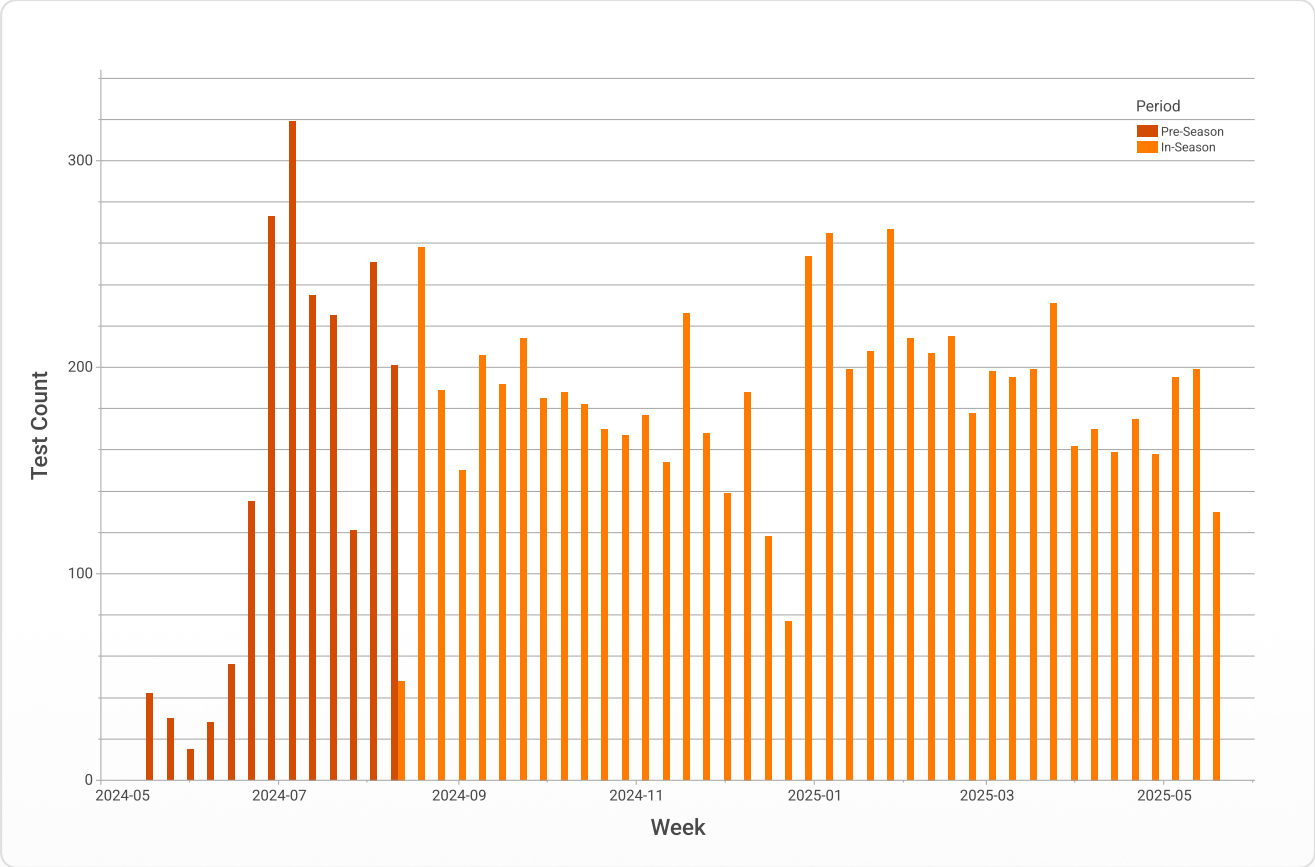
Weekly test schedule for the four most popular ForceFrame tests in the 2024/25 season.

ForceFrame **Trends**

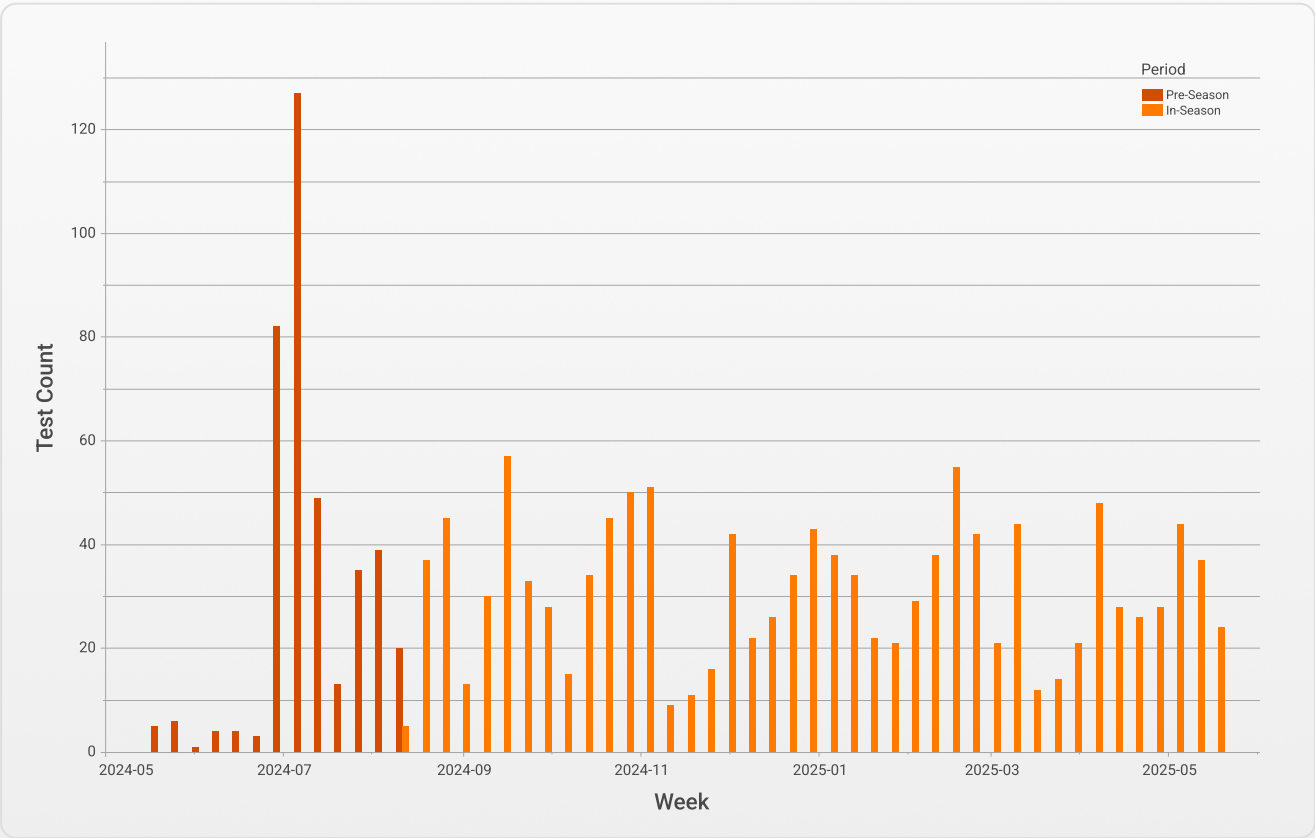
In the 2024/25 season, hip ADD 60° peak force displayed a notable decline over the course of a week, with the lowest scores typically observed on a Friday. Further, the hip ADD:ABD ratio was typically lowest on Thursdays, which may support these results being affected by mid-week training loads.

Of note, the hip ADD:ABD ratio obtained from the hip ADD/ABD supine (ankle) test position dropped from July until the post-Christmas period, potentially indicating an alteration in muscle balance to exposure to competition. Furthermore, the peaking of hip adductor force toward the end of the season coincided with increased peak Nordic force.

The relationship between adductor and hamstring muscle strength is discussed further in the section "Hip Adductor vs. Nordic Strength."

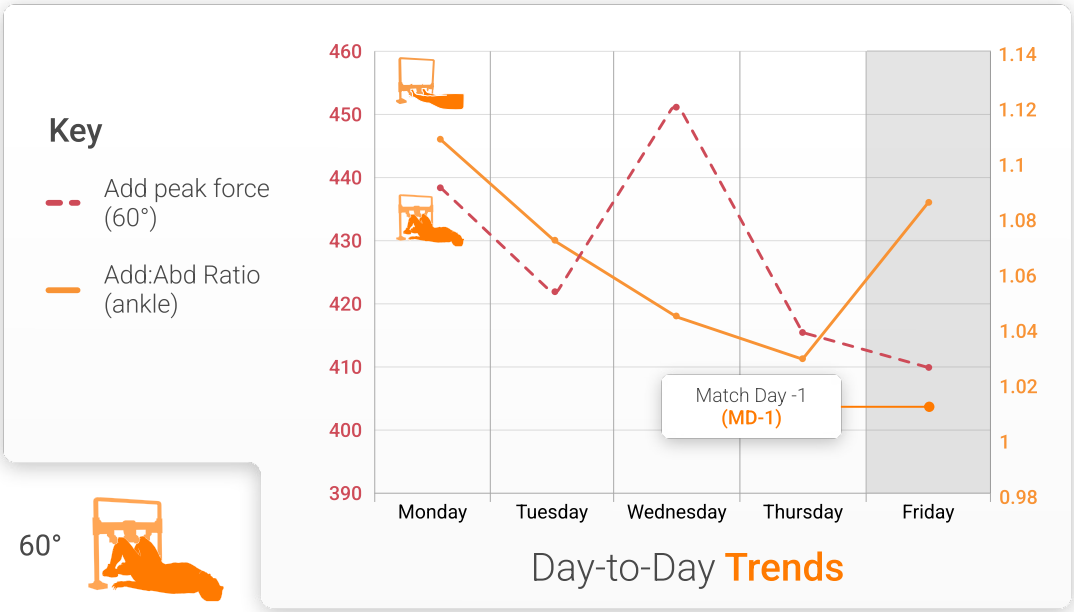


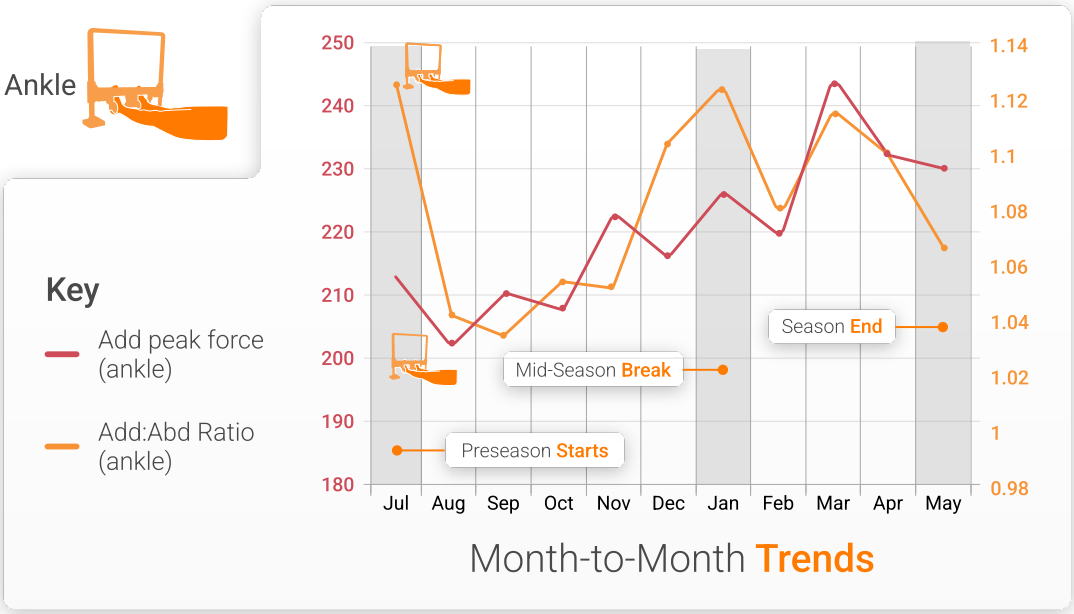
Hip ADD/ABD 60° weekly usage.



Hip ADD/ABD supine (ankle) weekly usage.

Hip
ADD ABD





Expert **Tip:**

As indicated in the following table, hip adductor and abductor strength of the right and left limbs in Premier League athletes are highly correlated. Significant between-limb imbalances may indicate pain or pathology and have previously been associated with an elevated risk of hip and groin injury (e.g., Bourne et al., 2020). When large imbalances are observed, check body positioning and verify correct pad contact; force applied off-center can introduce artifacts and distort strength scores.

Dr Matthew Bourne
Associate Professor, Griffith University

	Peak Hip Adductor Force Between-Limb Correlation		Peak Hip Abductor Force Between-Limb Correlation	
Hip ADD/ABD Test Position	R^2 Adjusted	RMSE (N)	R^2 Adjusted	RMSE (N)
45°	0.93*	27N	0.91*	28N
60°	0.92*	31N	0.90*	26N
90°	0.94*	24N	0.92*	29N
Supine (Ankle)	0.92*	17N	0.90*	17N

*RMSE = Root Mean Square Error

Between-limb correlations for peak hip adductor and abductor force at the different hip ADD/ABD test positions (*P < 0.001).

Hip Adductor vs. Nordic Strength

The functional relationship between hamstring and hip adductor muscle groups – particularly during sprinting – is well understood, yet relatively underexplored in sports injury literature.
Often called the **"fourth hamstring,"** the adductor magnus plays a role in hip extension, particularly when the hip is flexed.

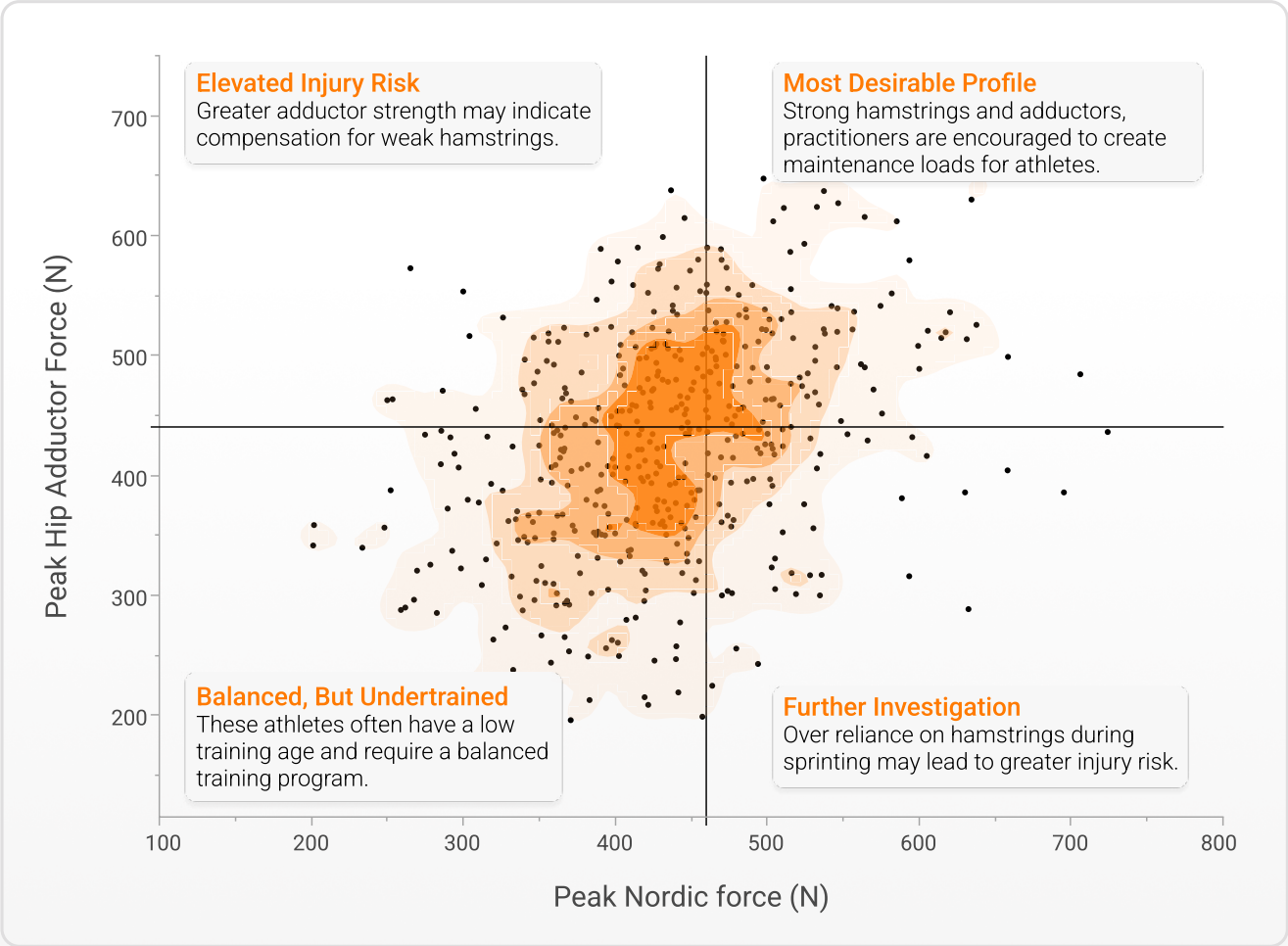
Chumanov et al. (2007) highlighted the adductor magnus' potential to reduce biceps femoris (BF) stretch during the swing phase of sprinting – a phase presumably associated with injury risk.

This reduction in BF stretch is significant, as acute hamstring strain injury may be linked to high levels of negative musculotendon work accumulated over repeated strides and neuromuscular coordination changes that induce excessive hamstring stretch.

Weakness or dysfunction of the adductor magnus may increase demand on the hamstrings, particularly the biceps femoris long head (most injury-prone).

…the interaction between adductor and hamstring strength may have implications for **injury risk assessments, load monitoring and return-to-play decision-making.**

Understanding the interaction between adductor and hamstring strength may have implications for injury risk assessments, load monitoring and return-to-play decision-making. The quadrant chart below provides a practical framework to understand the relationship between these muscle groups and guide training objectives:



Peak hip adductor force (from the hip ADD/ABD 60° test) compared with peak Nordic force.

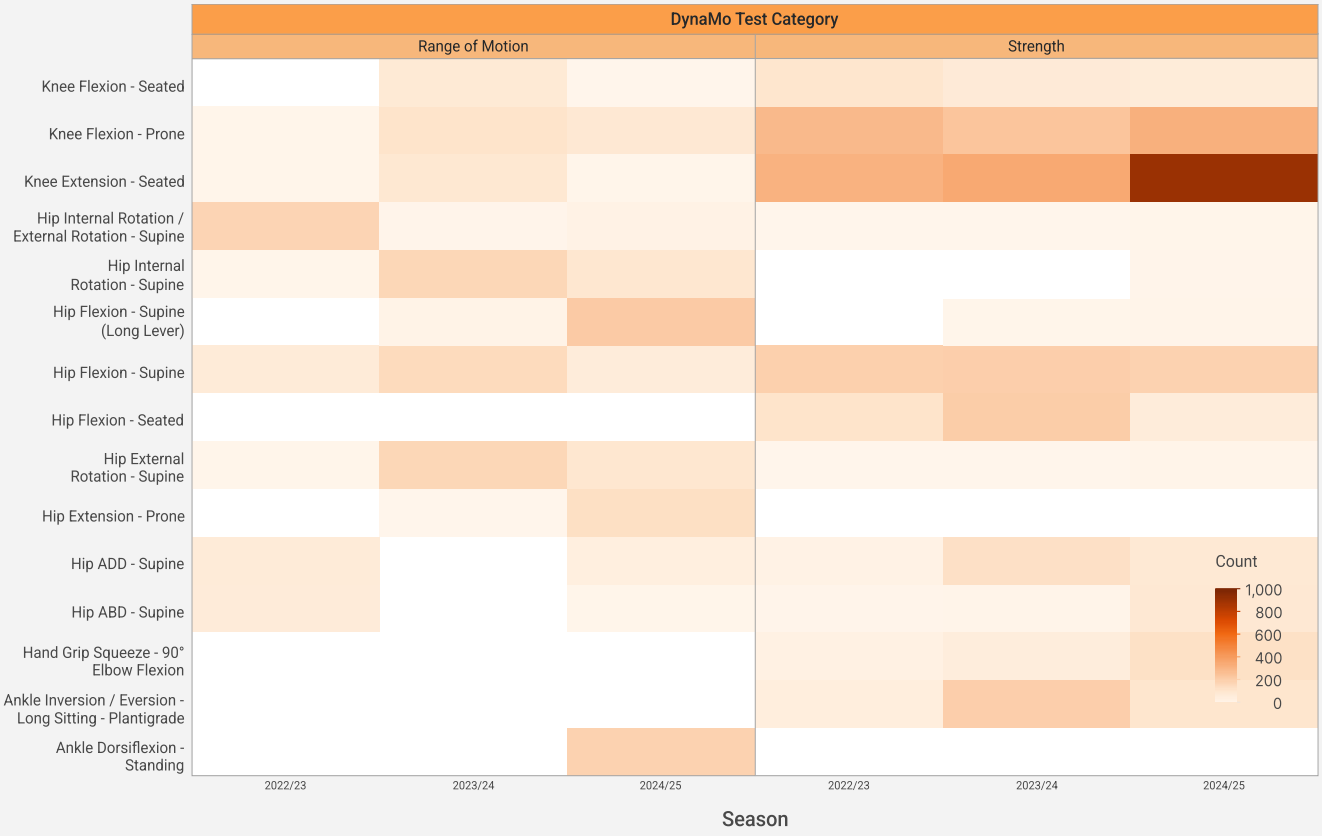
Emerging VALD Systems

Beyond the most popular VALD systems in the Premier League – ForceDecks, NordBord and ForceFrame – recent seasons have seen significant increases in the adoption and usage of DynaMo Handheld Strength and ROM System and SmartSpeed Timing Gate System.

DynaMo

The DynaMo range – comprised of DynaMo Lite, DynaMo Plus and the DynaMo Max – is a newer addition to the VALD system suite, with usage data now available for the past three Premier League seasons. Adoption of these devices has steadily grown, with the total number of tests increasing from 2,264 in the 2020/21 season to 4,661 in the current season.

Season	ROM Tests			Strength Tests			All
	Pre-Season	In-Season	All	Pre-Season	In-Season	All	
2022/23	345	138	483	599	1,182	1,781	2,264
2023/24	1,057	139	1,196	915	1,416	2,331	3,527
2024/25	1,016	278	1,294	984	2,383	3,367	4,661
All	2,418	555	2,973	2,498	4,981	7,479	10,452



DynaMo weekly use from season 2022/23 to 2024/25.

In the 2024/25 Premier League season, a total of 136 unique DynaMo test types were used, made up of 109 strength tests and 27 ROM tests.

…a total of **136 unique DynaMo test types** were used…

The most popular DynaMo strength tests were:

- Knee extension – seated
- Knee flexion prone

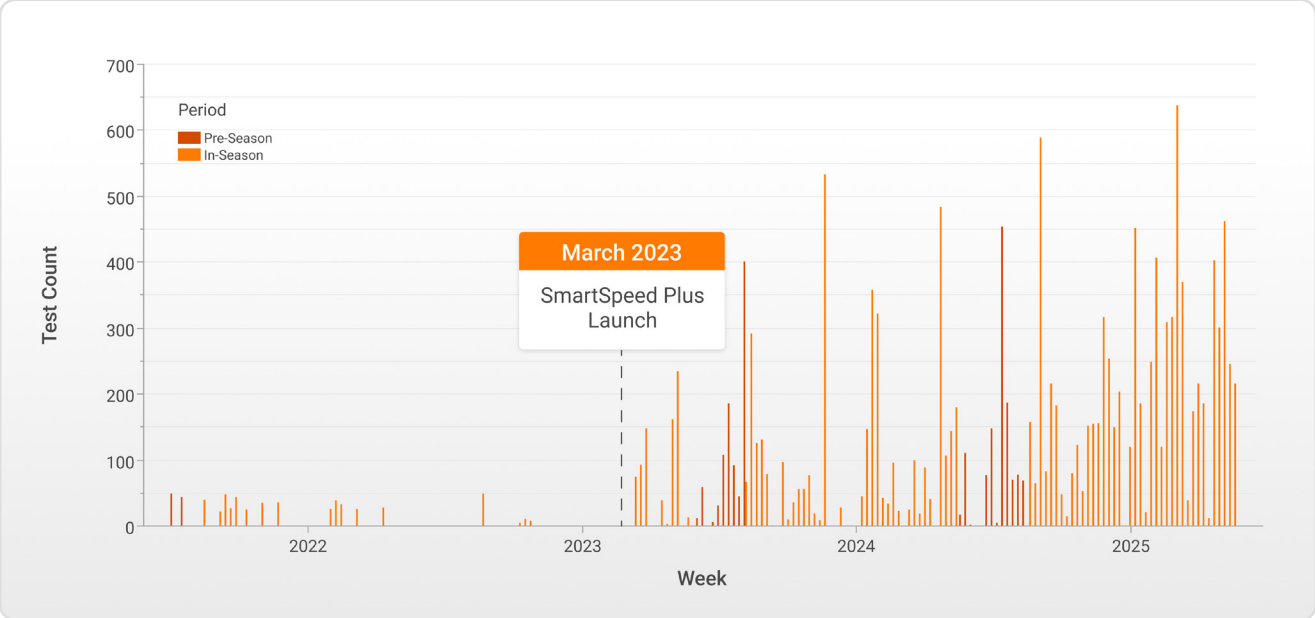
For ROM, the most popular test was hip flexion in supine (long lever).

SmartSpeed

Speed is critical to football performance, and since the launch of the upgraded SmartSpeed Plus in 2023, nearly half of the Premier League has implemented the system to measure and develop speed, agility and reactivity.

…nearly 10,000 SmartSpeed tests were recorded – almost double as many as in the season prior.

SmartSpeed has now been used consistently for two consecutive seasons, with usage growing quickly. In 2024/25, nearly 10,000 SmartSpeed tests were recorded – almost double as many as in the season prior.



Weekly usage of the SmartSpeed system since VALD's acquisition in 2021 and launch of SmartSpeed Plus in 2023.

Fifteen SmartSpeed test types were used in the 2024/25 season. The most popular tests were:

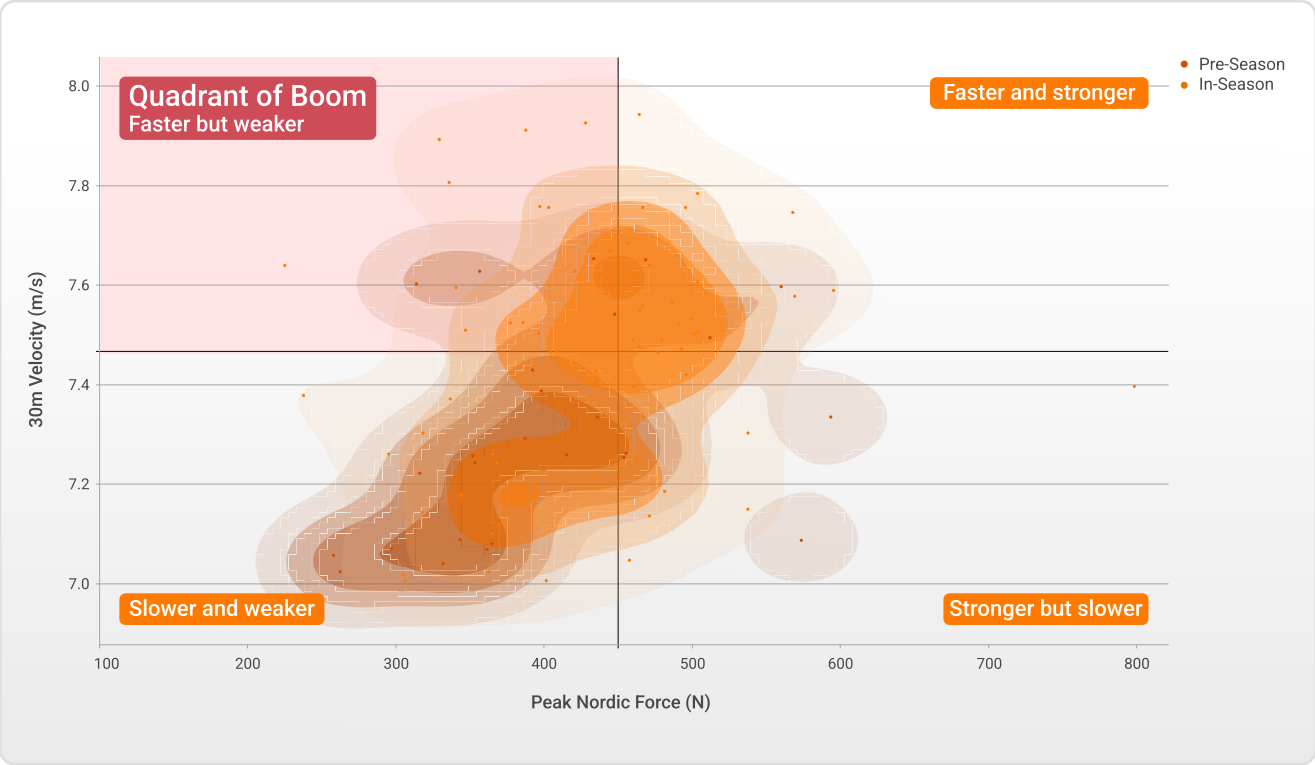
- 30m sprint
- 20m sprint
- 5-0-5 drill

The combination of SmartSpeed and NordBord outcome measures may also help identify outliers, understand interactions between data and guide performance and injury prevention decision-making.

The Quadrant of Boom is intended to help assess an athlete's **readiness to perform and potential risk of hamstring strain injury.**

The Quadrant of Boom is a new framework proposed by Dr. Morgan Williams and Dr. Matthew Bourne that plots sprint speed against Nordic hamstring strength. The Quadrant of Boom is intended to help assess an athlete's readiness to perform and the potential risk of hamstring strain injury.

In the Premier League, athletes typically improve eccentric hamstring strength and sprint speed from pre-season to in-season. However, data from other cohorts suggest those with prior hamstring injuries are less likely to make these strength gains (e.g., Opar et al., 2015) – and often display persistent deficits in peak Nordic force and sprint performance. The Quadrant of Boom offers a practical model for tracking these changes and identifying at-risk players. Read the full blog here.



Quadrant of Boom: Peak Nordic force (N) and 30m velocity (m/s) for male Premier League athletes in the pre-season (blue) and in-season (orange) periods.

What Next

For over a decade, the Premier League has used and trusted VALD systems in the monitoring, management, development and rehabilitation of their athletes. Over this time, both VALD systems and Premier League clubs' implementation of them have advanced significantly.

Together, this has created what is likely the largest and most powerful musculoskeletal dataset on the Premier League in existence. Finally, VALD's Data Lakehouse has enabled a new level of analysis never before possible, and this report is the result. However, it is just the beginning.

As a VALD user, you can expect to see more powerful reports, insights and resources like this to be made available to you in the near future. If there is anything in particular you would like to see, let us know!

We are excited to discover our clients' questions and – within the important bounds of data privacy and security – we will do our best to answer them.

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