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Sprint Performance Characteristics in Female Gaelic Football: Positional Profiles and Velocity-Time Metrics

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Key points

- Inter-county female Gaelic footballers are faster than club players across all sprint distances, especially at longer distances.
- Maximum sprint speed acts as a performance ceiling and differentiator between playing standards, with inter-county players sustaining acceleration over a greater distance.
- First study to provide sprint benchmarks by playing position for female Gaelic footballers.

Title: Sprint Performance Characteristics in Female Team Sport: Positional Profiles and Velocity-Time Metrics

Abstract

Background: Although participation in female team sports has expanded rapidly, research on sprint performance, particularly across positional profiles and velocity-time, remains limited. Providing these data allows practitioners to establish normative values for comparison and quantify potential differences between playing standards, thereby supporting more informed positional profiling and talent identification within female team sport.

Purpose: To compare sprint performance between inter-county and club female team sport athletes and to report velocity-time metrics by playing position, presented for the first time in this population.

Methods: One hundred and six female team sport athletes (inter-county: 29; club: 77) completed two maximal 40 m sprints on a synthetic indoor track. Sprint times were recorded at 5, 10, 20, 30, and 40 m using dual-beam timing gates. Maximum sprint speed and relative velocity–time metrics were calculated. Positional group data were analysed descriptively; between-group differences were assessed using independent samples t-tests or Mann–Whitney U tests, with effect sizes calculated (Cohen's *d*, *r*).

Results: Inter-county players were significantly faster than club players across all distances (small to medium effect sizes) and achieved higher maximum sprint speeds (large effect size). Club players demonstrated significantly greater relative sprint velocity between 0–10 m and 10–20 m (medium effect sizes).

Conclusions: Sprint performance and maximum sprint speed distinguish inter-county from club female team sport athletes. These findings also establish novel positional benchmarks for sprint profiling and athlete development in female team sports.

Keywords: Acceleration, Maximal Velocity, Field-Based Testing, Gaelic football, Speed Testing

Introduction

Participation in female team sports has grown rapidly in recent decades, with increased visibility, professionalism, and scientific interest driving the development of evidence-based training and performance strategies (Emmonds et al., 2019; Vescovi, 2014). Gaelic football, in particular, is one of the most widely played female sports in Ireland, with over 100,000 organisational members and a playing population spread across inter-county and club levels (Hughes et al., 2024; O'Connor et al., 2021). Regardless of this scale, scientific research on physical performance in the sport remains limited.

As participation and professionalism continue to expand, there is an increasing need for sport-specific performance data to support evidence-based preparation and player development pathways in the female game.

The sports science literature also remains disproportionately focused on male athletes, with a relative scarcity of data on female cohorts, particularly regarding physical performance characteristics such as sprinting ability (Emmonds et al., 2019; Molohan et al., 2023; Mujika & Taipale, 2019). Sports such as soccer, rugby sevens, Australian rules football, and Gaelic football, are typically high intensity, intermittent, and invasive in nature, requiring a complex interplay of physical, technical, tactical, and psychological attributes (Clarke et al., 2018; Datson et al., 2014; Duggan et al., 2022; Jackman et al., 2023; Kelly et al., 2022; Sella et al., 2019). Across these sports, qualities such as strength, power, and especially speed are widely recognised as critical to performance. Speed is commonly assessed via linear sprint performance (Altmann et al., 2019; McGuinness et al., 2024). Short-sprint performance (i.e., distances ranging from 0-20 m) are used as an surrogate measure of acceleration while long-sprint performance (i.e., distances >20 m) is often used as a measure of an athlete's maximal-speed ability or calculate an estimate of their maximum sprinting speed (MSS) (Nicholson et al., 2021, 2022). Acceleration ability and MSS are essential in invasive team sports such as female Gaelic football (Black et al., 2018; Datson et al., 2014; Molohan et al., 2023; Vescovi, 2012). Acceleration plays a pivotal role as the fastest players over short distances are more likely to win the race and duel for possession (Duggan et al., 2022; T. A. Haugen et al., 2012; Young et al., 2018). Higher levels of MSS aid offensive players in evading opponents and creating scoring chances while defensively, MSS facilitates pursuit and the execution of game-saving tackles or blocks (Duggan et al., 2020; Young et al., 2018).

Evidence from female soccer and rugby sevens indicates that sprint performance over 10–20 m can distinguish between playing standards (e.g., elite vs. sub-elite, selected vs. non-selected) (Clarke et al., 2017; Vescovi, 2012), with longer sprint tests (30–50 m) also differentiating between drafted and non-drafted athletes (Sella et al., 2019; Vescovi, 2012). However, comparative sprint data across competitive levels, and particularly positional data, remain limited in female athletes, and are largely absent in some codes, including Gaelic football (Molohan et al., 2023). Establishing these benchmarks is essential for practitioners aiming to guide talent pathways, evaluate positional standards, and inform training priorities within the female game.

Relative sprint metrics, such as average velocity achieved over a given distance expressed as a percentage of MSS, offer a more nuanced understanding of sprint ability (Healy et al., 2019). For instance, ‘faster’ male sprinters have been shown to operate at a lower percentage of their MSS over 0– 40 m relative to their ‘slower’ counterparts, reflecting prolonged acceleration phases enabled by higher MSS (Healy et al., 2019). This approach may help coaches individualise training toward acceleration or MSS development, but it remains underexplored in female athletes. Profile-guided resistance training has been shown to produce greater improvements in jump performance than uniform programmes, demonstrating the value of targeting an athlete’s identified weaker area (Jiménez-Reyes et al., 2017). Although methodologically distinct, a similar principle may apply to relative acceleration profiling, where identifying whether an athlete is proportionally stronger in early acceleration or maximal-speed phases could help practitioners bias training more effectively. Applying this framework may therefore offer more actionable and individualised insights than distance-based sprint outcomes alone, addressing a key gap in current practice.

In female-specific sports science research, it is recommended that descriptive work is first conducted to understand the current level of performance (Bishop, 2008; Emmonds et al., 2019). Furthermore, reporting data by playing position can provide practical insights for talent identification, development, and programming in team sport settings. Therefore, the current study aimed to compare the short- (5, 10, and 20 m) and long- (30 and 40 m) linear sprint performance, relative speed metrics, and MSS between inter-county and club playing standards. A secondary aim was to descriptively profile sprint performance by positional group within inter-county and club cohorts. We hypothesised that the inter-county cohort would exhibit faster sprint times across all sprint distances (5, 10, 20, 30, and 40 m) as well as displaying greater MSS, similar to playing standard differences in other female team sports. We hypothesised that differences would exist between inter-county and club players for relative speed metrics over 0-10 m and 10-20 m, based on the comparable values identified between faster and slower athletes to date.

Materials and Methods

The objectives of the current cross-sectional study were to examine playing standard differences in sprint performance between inter-county and club female Gaelic football players as well as report positional data. All sprint testing was conducted on a synthetic indoor running track using a dual-beam timing gate system. Data were collected over two competitive seasons (2022 and 2023) during the in season (May-September) period between 16:00-21:00.

Participants

Twenty-nine (n=29) inter-county and seventy-seven (n=77) club female Gaelic football players participated in the study. The median (IQR) age, mean ± SD height, and body mass for the combined group (n = 106) were: 24 (8) years, 1.67 ± 0.06 m, and 66.0 ± 7.8 kg. Players were eligible if they were ≥16 years old and actively competing in adult-level Gaelic football at either inter-county or club standard (Table 1). For added context, in Gaelic football all players represent their local club, but the most talented are selected for their county team. Club players typically train 2-3 days per week with 1 2, strength-training sessions, while inter-county players follow more intensive, consistent programs and have access to superior coaching, strength and conditioning, nutrition, medical, and psychological support. Although inter-county players remain amateur, they often strive to train and prepare at professional standards wherever possible. Using McKay' classification, inter-county players correspond to Tier 3: Highly Trained/National Level, and club players to Tier 2: Trained/Developmental (McKay et al., 2021). Both groups are further divided into senior, intermediate, and junior competitions. Uniquely, players do not transfer between clubs or counties, preserving strong local affiliations. In the present study, the inter-county group included 8 senior and 21 intermediate inter-county players, while the club group consisted of 25 senior, 12 intermediate, and 40 junior club-level players. Positional representation was as follows: full-back line (n = 3 inter-county, 17 club); half-back line (n = 7 inter-county, 22 club); midfield (n = 8 inter-county, 10 club); half-forward line (n = 8 inter-county, 16 club); full-forward line (n = 3 inter-county, 12 club). Positional classification was determined by asking each participant to report the position they played most often for their team. All participants were informed of the testing procedures, including associated risks and benefits, prior to giving written informed consent. Parental consent was obtained for participants under 18 years of age. Ethical approval for the study was granted by the Institution's Research Ethics Committee. All participants completed a PAR-Q and confirmed they were injury-free at the time of testing. They were instructed to abstain from alcohol and exercise for at least 24 hours and to avoid caffeine for 12 hours before testing. Testing was performed in standard training attire (i.e., jersey, shorts, and sports trainers).

Procedures

Participants completed a ten-minute RAMP (raise, activate, mobilise, potentiate) warm-up consisting of jogging, progressive running, dynamic stretches, bodyweight exercises, and jumping (Jeffreys, 2007). Subsequently, two sub-maximal sprints were performed at 80% and 90% of participants' self perceived maximum effort separated by three minutes of passive recovery (T. A. Haugen et al., 2012).

For data collection, two maximal effort sprints were performed over 40 m with a minimum of three minutes (maximum of six minutes) of passive recovery provided between each sprint (T. A. Haugen et al., 2012).

Nine dual-beam (Witty, Microgate, Bolanzo, Italy) timing gates were placed at 5 m intervals (0, 5, 10, 15, 20, 25, 30, 35, 40 m) over 40 m. It is recommended that timing gates are placed at approximately hip height (Altmann et al. 2017). Thus, for the current cohort the top and bottom photocells (aligned vertically and separated by ~ 0.2 m) were placed at a height of 0.75 and 0.95 m, respectively. Players assumed a two-point staggered stance with their preferred foot in front and placed the 'tip of their toe' on a starting line 0.5 m behind the initial timing gate. Two orange cones were placed 2.5 m beyond the final timing gate to discourage early deceleration (Altmann et al., 2015). Participants were instructed to "run as fast as possible past the orange cones". The trial was initiated on the participants' own time. Participants were instructed to avoid rocking or moving backwards before initiating their trial. If these movements were performed, trials were made void. The same investigator visually inspected all sprint starts from a lateral viewpoint within ~3 m of the participant. The reporting methods employed in this study follow linear sprint testing method reporting recommendations and have been shown to have excellent reliability for assessing MSS (McGuinness et al., 2024, 2025). Given the established reliability of the testing methods and typically the fastest trial is reported in the sprint literature, the fastest trial 40 m sprint was used for data analysis (Al Haddad et al., 2015). ‘Short-sprint’ performance was assessed using distances of 5, 10 and 20 m whereas 30 and 40 m were used for the assessment of ‘long-sprint’ performance (Nicholson et al., 2021). MSS was estimated as the fastest 5 m split time over 40 m divided by 5 m. Relative speed metrics were calculated for the early acceleration (0-10 m) and late acceleration phase (10-20 m) using a similar method to Healy et al. (2019) where the average speed during both phases was expressed as a percentage of MSS.

Statistical Analysis

Statistical analyses were performed using the software *R* (4.2.0) (R Core Team 2022) and *R* Studio (version 4.1.0). Raw data for the statistical analysis can be viewed in supplementary file 1 and the R code can be viewed in supplementary file 2. The data and statistical analyses are available to view in the supplementary file. The normality of the data was assessed by visually examining the histograms and quantile-quantile plots in addition to a Shapiro-Wilk’s test with the alpha level set at 0.05. Age, the average velocity as a percentage of MSS from 0-10 and 10-20 m and all sprint times were not normally distributed and were described using the median (IQR). Mass, height, and MSS were normally distributed and were described using mean ± SD. A two-way random model intraclass correlation coefficient (ICC) was used to determine the inter-trial reliability of the sprint times, MSS, and the average velocity as a percentage of MSS from 0-10 and 10-20 m for the participants who had two valid trials (n=87). Reliability was interpreted as poor (ICC $\leq$ 0.49), moderate (0.50 $\leq$ ICC < 0.74), good (0.75 $\leq$ ICC < 0.90), and excellent (ICC > 0.90) (Sainani, 2017).

Independent sample t-tests were conducted for normally distributed data to determine whether statistically significant differences existed between inter-county and club players for mass, height, and MSS. Cohen's d effect sizes were calculated for between-group differences and interpreted as trivial ($d_z < 0.2$), small ($0.2 \leq d_z < 0.5$), moderate ($0.5 \leq d_z < 0.8$) and large ($d_z \geq 0.8$) (Cohen, 1988). Mann-Whitney U tests were conducted for non-normally distributed data to determine whether statistically significant differences existed between inter-county and club players for all sprint times, and the average velocity as a percentage of MSS from 0-10 and 10-20 m. The effect size, r, was calculated using the following equation:

$$r = \frac{z}{\sqrt{N}}$$

where z is the standardised test statistic from the Mann-Whitney U test and N is the total number of observations. The *r* value was interpreted as follows: trivial (< 0.1), small 0.1 ≤ 0.29); medium (0.3 ≤ 0.49); and large (> 0.5) (Cohen, 1988). A common language effect size (CLES), the probability of superiority, was calculated for the Mann-Whitney U tests and the independent sample t-tests. The probability of superiority refers to the probability that an individual selected randomly from the inter-county group will obtain a higher score than an individual selected randomly from the club group (McGraw & Wong, 1992). CLES values <50% for all sprint times represented better performance (quicker times) by the inter-county group compared to the club group. The Mann-Whitney U statistic was converted to the probability of superiority using the following equation:

$$CLES = \frac{U}{n1 \times n2},$$

where U is the Mann-Whitney U statistic, n_1 and n_2 are the sample sizes of the inter-county and club groups respectively. Cohen's d was converted to the probability of superiority using the "effectsize" *R* package.

A sensitivity analysis for this study's sample size was performed using G*Power 3.1. The t-test test family was selected alongside the statistical test (means: difference between two independent means (two groups). The analysis revealed that a Cohen's d effect size of 0.62 could be identified with 80% statistical power, and a minimal statistically detectable effect size of 0.43 given an alpha level of 0.05.

Two-tailed hypothesis testing was undertaken as the authors were open to the possibility that the inter-county group were superior to the club or vice versa. A false-discovery rate was used to control for the number of hypotheses tested (Benjamini & Hochberg, 1995).

Descriptive statistics were also calculated for positional groups (full-backs, half-backs, midfielders, half-forwards, full-forwards), however, between-group comparisons were not assessed due to limitations with the sample size.

Results

All dependent variables displayed moderate to excellent reliability with all ICCs above 0.66. Reliability was considered excellent for 20, 30, and 40 m sprint times (ICC range: 0.93-0.95) and MSS (ICC: 0.95). Reliability was considered good for 5 and 10 m sprint times (ICC range: 0.77-0.88). Reliability was considered moderate for the average velocity as a percentage of MSS between 0-10 and 10-20 m (ICC range: 0.66-0.71).

Descriptive statistics, effect sizes, and the CLES are presented for all variables for inter-county and club players in Table 1. Inter-county players were significantly faster (*p* <0.005) than club players over all sprint distances. A small effect was observed for 5 m sprint time whereas moderate effects were observed for all other sprint times. For the sprint times from 5 to 40 m, the CLES ranged 64.7 to 73%. MSS was significantly (*p* <0.001) faster for inter-county versus club groups (large effect; CLES = 76.9%). The average velocity as a percentage of MSS achieved between 0-10 and 10-20 m were significantly (*p* <0.05) greater for club versus inter-county players. These were considered medium and small effects, respectively.

Descriptive statistics (mean ± SD) are presented for inter-county and club female Gaelic football players as well as the mean ± SD for both cohorts combined (Table 2). The distribution of all variables is visualised in Figure 1 and Figure 2.

Table 1 Descriptive statistics and effect sizes for anthropometric and sprint performance data comparing inter-county and club female Gaelic football players. Group-level results are reported to represent the combined performance of both cohorts.

Variable	**Group (n=106)**	**Inter-county (n=29)**	**Club (n=77)**	***p***	**ES**	**CLES (%)**
Age (years)	24 (8)	22 (8)	24 (10)	0.859	r = 0.02	50.9
Height (m)	1.67 ± 0.06	1.67 ± 0.05	1.66 ± 0.06	0.523	d = 0.14	53.9
Body mass (kg)	66.0 ± 7.8	67.8 ± 6.3	65.3 ± 8.3	0.149	d = 0.32	59.0
5 m (s)	1.16 (0.09)	1.14 (0.05)	1.17 (0.09)	0.002*	r = 0.29	64.7
10 m (s)	1.98 (0.14)	1.92 (0.09)	1.99 (0.15)	<0.001*	r = 0.36	68.1
20 m (s)	3.42 (0.23)	3.31 (0.16)	3.46 (0.24)	<0.001*	r = 0.42	70.9
30 m (s)	4.82 (0.34)	4.64 (0.21)	4.87 (0.33)	<0.001*	r = 0.46	73.0
40 m (s)	6.22 (0.44)	6.00 (0.3)	6.31 (0.47)	<0.001*	r = 0.46	73.0
MSS ($m \cdot s^{-1}$)	7.23 ± 0.46	7.55 ± 0.34	7.11 ± 0.45	<0.001*	d = 1.04	76.9
0-10 m velocity (% MSS)	69.6 (3.2)	68.8 (2.5)	70.3 (3.1)	0.001*	r = 0.31	65.5
10-20 m velocity (% MSS)	95.1 (2.1)	94.7 (2.3)	95.6 (1.7)	0.021*	r = 0.22	61.2

Note Data presented as mean ± SD or median (interquartile range). * $p < \alpha$

ES Effect size (Cohen's d or r), ***CLES*** Common Language Effect Size, ***MSS*** Maximum Sprinting Speed.

Table 2 Descriptive statistics, mean ± SD or median (IQR), for the positional groups of combined, inter-county, and club female Gaelic football players. Group level results are reported to represent the combined performance of both cohorts.

Variable	Group(n=106)					Inter-county (n=29)					Club (n=77)				
	FB	HB	MF	HF	FF	FB	HB	MF	HF	FF	FB	HB	MF	HF	FF
5 m (s)	1.19 ± 0.06	1.16 ± 0.07	1.14 ± 0.06	1.18 ± 0.05	1.18 ± 0.07	1.18 ± 0.08	1.11 ± 0.03	1.11 + 0.04	1.18 ± 0.06	1.12 ± 0.06	1.19 ± 0.06	1.18 ± 0.08	1.16 ± 0.06	1.18 ± 0.05	1.19 ± 0.06
10 m (s)	2.04 ± 0.10	1.98 ± 0.11	1.93 (0.08)	2.00 ± 0.08	2.01 ± 0.11	2.03 ± 0.13	1.89 ± 0.04	1.90 ± 0.05	1.99 ± 0.06	1.92 ± 0.09	2.04 ± 0.10	2.01 ± 0.11	1.98 ± 0.09	2.01 ± 0.09	2.04 ± 0.11
20 m (s)	3.53 ± 0.17	3.43 ± 0.19	3.34 (0.14)	3.42 (0.16)	3.50 ± 0.21	3.51 ± 0.22	3.26 ± 0.05	3.29 ± 0.08	3.42 ± 0.09	3.30 ± 0.14	3.53 ± 0.17	3.48 ± 0.18	3.41 (0.13)	3.49 ± 0.16	3.55 ± 0.20
30 m (s)	4.97 ± 0.25	4.82 ± 0.27	4.68 (0.23)	4.80 (0.18)	4.94 ± 0.32	4.94 ± 0.33	4.57 ± 0.08	4.60 ± 0.11	4.79 ± 0.12	4.62 ± 0.20	4.98 ± 0.25	4.90 ± 0.27	4.78 (0.18)	4.91 ± 0.24	5.02 ± 0.29
40 m (s)	6.45 ± 0.39	6.21 ± 0.37	6.03 (0.31)	6.22 (0.28)	6.40 ± 0.44	6.42 ± 0.46	5.88 ± 0.11	5.91 ± 0.15	6.17 ± 0.13	5.94 ± 0.25	6.46 ± 0.39	6.32 ± 0.36	6.18 (0.19)	6.37 ± 0.33	6.51 ± 0.41
MSS ($m \cdot s^{-1}$)	7.04 ± 0.43	7.32 ± 0.48	7.51 ± 0.39	7.17 ± 0.35	7.08 ± 0.55	7.07 ± 0.57	7.71 ± 0.16	7.71 ± 0.25	7.37 ± 0.17	7.46 (0.36)	7.03 ± 0.42	7.19 ± 0.48	7.35 ± 0.42	7.07 ± 0.38	6.92 ± 0.47
	(n=20)	**(n=29)**	**(n=18)**	**(n=24)**	**(n=15)**	**(n=3)**	**(n=7)**	**(n=8)**	**(n=8)**	**(n=3)**	**(n=17)**	**(n=22)**	**(n=10)**	**(n=16)**	**(n=12)**

Note: Data presented as mean ± SD or median (interquartile range).

FB Full-back, **HB** Half-back, **MF** Midfield, **HF** Half-forward, **FF** Full-forward, **MSS** Maximum Sprinting Speed

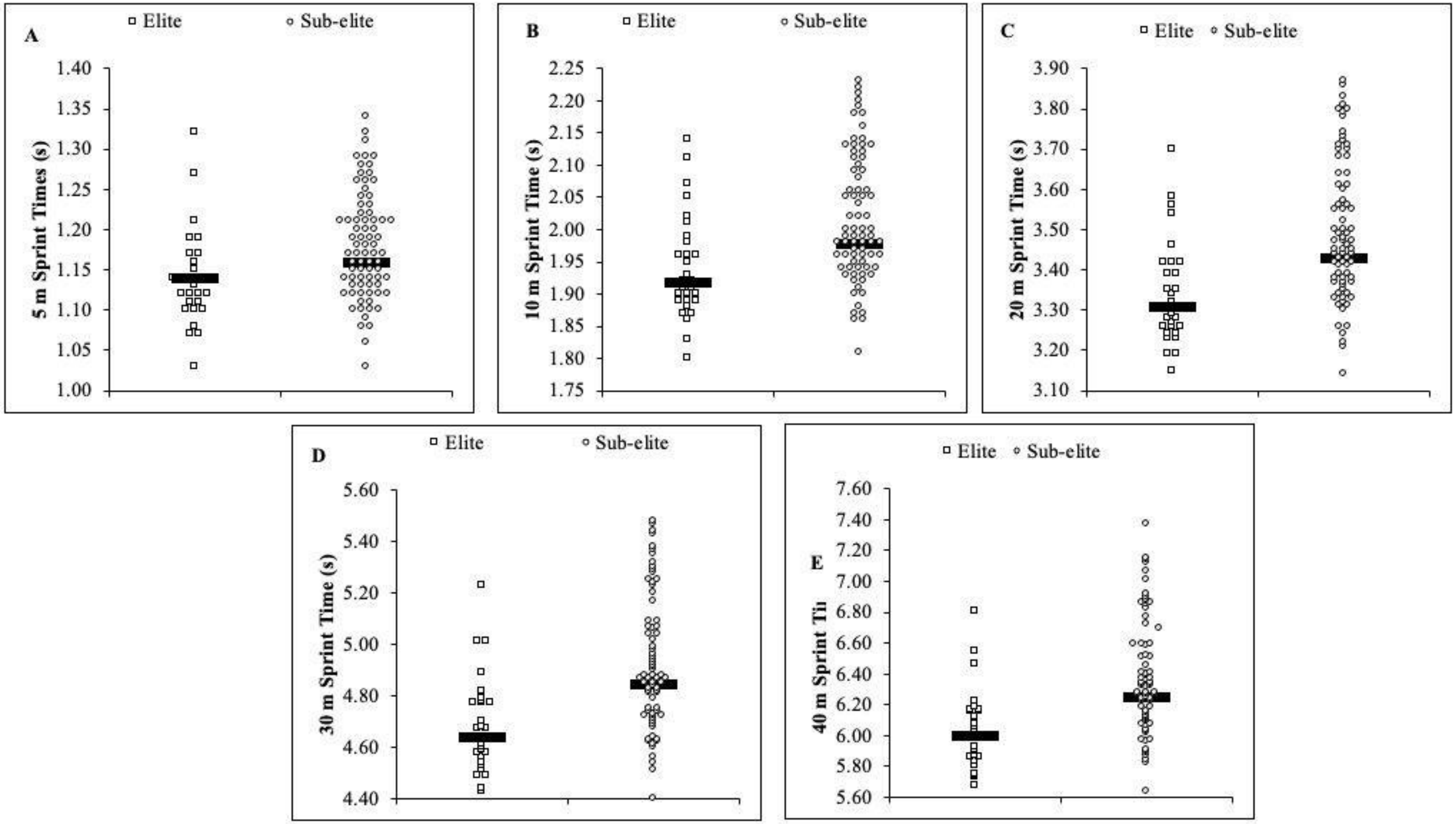

Figure 1 Sprint times over 5, 10, 20, 30, and 40 m for inter-county and club female Gaelic football players. The black lines represent the median while the points represent individual times and speeds.

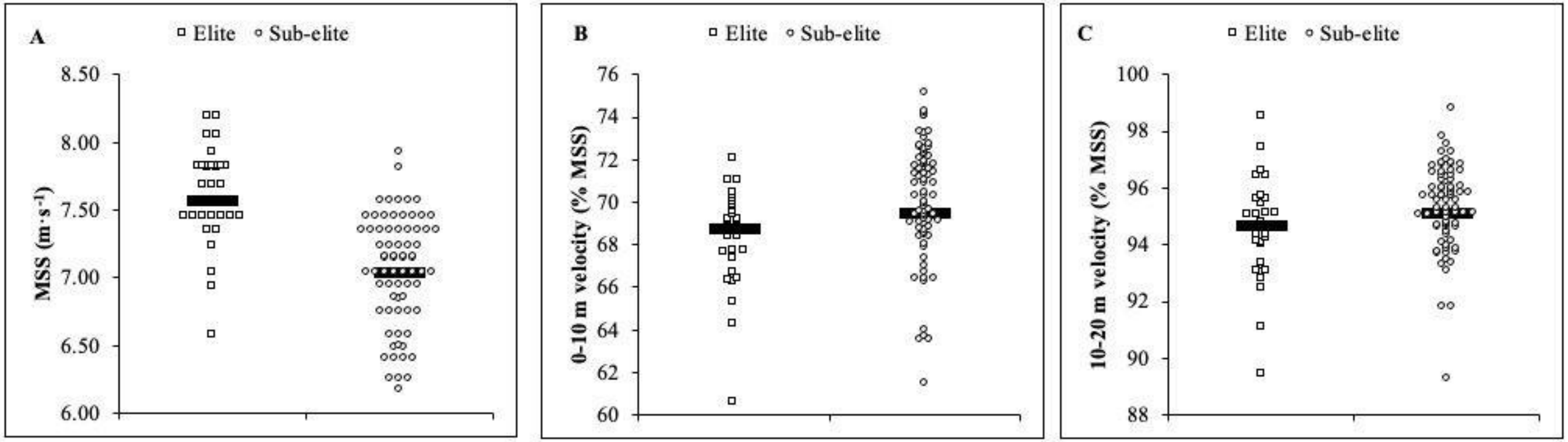

Figure 2 MSS and velocity-time metrics for inter-county and club female Gaelic football groups. Black lines represent the median while the points represent speeds and percentages.

Discussion

The current study is the first to compare short- and long- sprint performance in inter-county and club female Gaelic football players. Specifically, we examined short- (5-20 m) and long- sprint (20-40 m) performance, relative acceleration, and MSS in inter-county and club female Gaelic footballers. Consistent with our hypotheses, the results demonstrate that inter-county players were significantly faster than club players over all sprint distances. The largest effects were observed over longer distances. Inter-county players possessed significantly greater MSS whereas club players attained a higher percentage MSS between 0-10 and 10-20 m.

Acceleration performance is an essential quality to possess in field-based team sport. This was reflected in the present study as short-sprint performance, a surrogate measure for acceleration, was significantly faster in inter-county players compared with club players (small-medium effects). Superior acceleration increases the likelihood of winning possession-related duels (Duggan et al., 2022), and even small differences in 20 m time (0.04–0.06 s) can translate into substantial spatial advantages of 0.3-0.5 m over an opponent (T. A. Haugen et al., 2014). These findings are consistent with research in female soccer and rugby, where sprint performance over 10–20 m reliably differentiates playing standards (Clarke et al., 2017; Vescovi, 2012).

Long-sprint performance, which reflects an athlete's ability to approach maximal speed, was also an important discriminator in the present study. Inter-county players demonstrated significantly faster 30 and 40 m times than club players (medium effects), supporting the relevance of MSS in female team sport for creating scoring opportunities and enabling defensive recovery. Notably, the performance gaps observed in Gaelic football (4.8% over 30 m; 4.9% over 40 m) surpass those typically reported in other female field sports (1.1%-2.8%) (Doyle et al., 2020; Gabbett, 2007; Sella et al., 2019), suggesting that maximal-speed ability may be an especially distinguishing characteristic in this population. This provides a logical extension of the short-sprint findings and further highlights the importance of comprehensive sprint profiling in female Gaelic football. Interestingly, the magnitude of differences between inter-county and club players increased as sprint distance increased, ranging from small effects at 5 m (r = 0.29) to medium effects at 40 m (r = 0.46). Consistent with this trend, the CLES increased from 64.7% at 5 m and to 73% over 40 m, with the probability of a club player outperforming an inter county player decreasing from approximately 1 in 3 at 5 m to 1 in 4 by 40 m.

These results suggest that both short- and long- sprint performance can be used to identify players with intercounty-level speed characteristics. Accordingly, coaches and practitioners can use these data for talent identification and benchmarking. The inter-county group values presented here may help evaluate current intercounty players: those whose acceleration or maximal-sprint performance is slower than the times observed in the inter-county cohort should prioritise training aimed at enhancing acceleration and/or maximal-speed qualities, depending on their specific deficit.

The performance differences observed across both sprint phases likely reflect disparities in the physical qualities underpinning acceleration and maximal-speed. Speed gains in females tend to plateau in mid-to-late adolescence without targeted strength and power training (Molohan et al., 2023), and key determinants of sprint performance, relative maximal strength, explosive strength, and reactive strength, are all strongly associated with short- and long- sprint ability in female athletes (Hughes et al., 2023; Nimphius et al., 2010; Peterson et al., 2006). Recent evidence has shown that inter-county female Gaelic footballers outperform club players in each of these strength qualities (moderate-large effects) (Hughes et al., 2024), which likely contributes to their superior sprint performance across both acceleration and maximal-speed phases. Collectively, these findings reinforce the importance of structured strength and conditioning programmes in developing the neuromuscular qualities necessary for high-level sprint performance in female Gaelic football.

A broader contextual factor that may further contribute to these differences is access to structured strength and conditioning support. A recent Gaelic Players Association survey reported that 36% of inter-county female players lack full access to strength and conditioning practitioners (Gaelic Players Association, 2022), yet the majority likely engage in structured training more consistently than their club peers. Consequently, while there may be an inherent or 'natural' gap in speed performance between cohorts, but this gap be amplified by greater exposure to speed- and strength- enhancing training among inter-county players. Addressing disparities in strength and conditioning provision may therefore be critical for supporting sprint development and reducing performance gaps across all levels of female Gaelic football.

Despite the clear relevance of maximal-speed capacity to performance, limited data exist on maximal-speed performance in female Gaelic football. Recently, Malone *et al.* (2023) and Whyte *et al.* (2024) have reported MSS and 30 m sprint performance in this population. The MSS values observed in the present study (7.55 ± 0.34 m·s^{-1}) were lower than those reported in senior inter-county female Gaelic football using GPS-derived measures (8.34 m·s^{-1}) (Malone et al., 2023), while 30 m sprint times were faster than those reported by Whyte *et al.* (2024; 4.98 ± 0.19 s). Although differences in sample composition may partly explain these findings, key methodological differences in speed assessment also exist, including variations in measurement systems, sprint protocols, and starting positions (T. Haugen & Buchheit, 2016; Massard et al., 2018; McGuinness et al., 2023). Consequently, when comparing sprint and maximal-speed data across studies, or when practitioners benchmark player performance against published values, methodological differences must be carefully considered to avoid misinterpretation.

Within the present study, examining relative speed metrics alongside absolute performance provides further insight into how inter-county and club players differ across the acceleration phase. To our knowledge, this is the first study to examine relative speed metrics in female team sport. Club players achieved a higher average velocity as a percentage of MSS between 0-10 and 10-20 m. However, inter-county players attained significantly greater absolute velocities over these distances, reflecting their faster sprint times. The lower relative MSS values in inter-county players suggest a more prolonged acceleration phase, particularly over the first 30 m. This likely reflects their lower MSS, such that a greater proportion of MSS is reached earlier in the sprint despite inferior absolute velocities.

The data suggest MSS may act as an upper limit or 'ceiling' for sprint performance, consistent with findings in male athletes (Clark et al., 2019; Healy et al., 2019; Slawinski et al., 2017). Healy *et al.* (2019) categorized 100 m male sprinters into 'faster' and 'slower' groups based on MSS, finding that slower sprinters reached a higher percentage of their MSS at 0-20 and 20-40 m, yet faster sprinters maintained greater absolute velocities. This was attributed to faster sprinters sustaining acceleration over longer distances due to their higher MSS. Similarly, Clark *et al.* (2019) studied NFL Combine athletes grouped by MSS, reporting similar acceleration profiles but suggesting MSS may limit acceleration performance. However, their use of a 36.6 m sprint likely underestimated MSS for these athletes, who can reach speeds up to 11.0 $m \cdot s^{-1}$ in competition (Sanchez et al., 2023). Additionally, no formal statistical test was conducted on the small (<2.5%) differences in relative acceleration. Collectively, these findings support the concept of MSS as a performance ceiling, whereby athletes with higher MSS sustain acceleration over longer distances and maintain superior absolute velocities across all sprint phases.

Limitations

Despite the valuable insights gained from this study, limitations must be acknowledged. First, the sample size by positional lines was limited and insufficient for the assessment of positional group differences. Further, senior inter-county players comprised of 30% of the inter-county cohort while there was an absence of inter-county players who competed at junior level. These data may not fully encapsulate the sprint performance of inter-county players across all playing levels. Additionally, data were collected over five months of the year which meant variations in performance due to training phases or seasonal changes may have affected the results. However, all players were in-season at the time of testing, and collecting sufficient data required an extended period for recruitment.

Conclusion

This study is the first to compare short- and long-sprint performance, maximal sprint speed, and relative acceleration metrics between inter-county and club adult female Gaelic football players. Inter-county players were faster across all sprint distances, with performance differences increasing as distance increased, highlighting maximal sprint speed as a key discriminator of playing level. While club players achieved a higher percentage of their maximal speed during early acceleration, inter-county players reached substantially higher absolute velocities and sustained acceleration over longer distances. These findings support the idea of maximal sprint speed acting as a performance ceiling that constrains overall sprint capability in female team-sport athletes.

Practically, both short- and long- sprint testing provide meaningful insights for talent identification, benchmarking, and performance monitoring in female Gaelic football. Training interventions should be individualised to target acceleration and/or maximal-speed deficits, underpinned by structured strength and conditioning programmes. The magnitude of observed performance gaps suggests that disparities in neuromuscular qualities, potentially compounded by unequal access to strength and conditioning availability and support, may contribute to differences between playing standards. Future research should examine positional sprint differences, match-play sprint characteristics, and barriers to strength training participation, particularly at club levels, to inform evidence-based player development pathways.

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Conflict of interest statement

The authors of the current manuscript have no conflicts on interest.

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height_m	mass_kg	age	positional_group	playing_status
1.62	72.2	21	full_back	intercounty
1.67	59.9	31	half_forward	intercounty
1.62	71.3	22	half_forward	intercounty
1.68	62.5	20	half_forward	intercounty
1.69	66.4	22	half_forward	intercounty
1.61	58.4	27	half_forward	intercounty
1.69	63.6	20	midfield	intercounty
1.59	59.1	24	half_back	intercounty
1.69	69.7	21	half_back	intercounty
1.63	56.6	21	midfield	intercounty
1.74	71.6	22	full_forward	intercounty
1.62	67.7	28	half_back	intercounty
1.63	76.8	25	full_back	intercounty
1.73	72.5	24	full_forward	intercounty
1.80	77.4	24	full_forward	intercounty
1.71	68.8	19	half_forward	intercounty
1.77	80.6	35	midfield	intercounty
1.7	64.5	20	half_back	intercounty
1.68	77.1	19	half_forward	intercounty
1.62	62.3	21	half_back	intercounty
1.64	70.8	24	full_back	intercounty
1.61	66.6	20	half_back	intercounty
1.75	73.3	30	midfield	intercounty
1.65	60.2	20	midfield	intercounty
1.67	63.5	36	midfield	intercounty
1.74	65.9	29	midfield	intercounty

1.63	65	33	half_back	intercounty
1.70	68.0	19	midfield	intercounty
1.63	73.3	27	half_forward	intercounty
1.67	68.3	25	half_forward	club
1.62	60.6	35	full_back	club
1.71	61.4	43	half_forward	club
1.63	60.0	20	half_forward	club
1.70	64.9	16	midfield	club
1.60	75.4	22	full_back	club
1.67	81.6	22	half_forward	club
1.68	70.2	23	full_back	club
1.57	57.3	19	half_back	club
1.71	66.7	19	half_back	club
1.54	51.6	27	half_forward	club
1.63	62.2	22	full_back	club
1.63	54.6	27	half_back	club
1.58	51.9	24	half_back	club
1.57	55.1	39	full_forward	club
1.75	64.4	20	half_back	club
1.64	62.7	20	midfield	club
1.71	65.3	16	half_forward	club
1.71	64.5	21	full_back	club
1.67	59.7	28	half_back	club
1.57	58.9	24	half_forward	club
1.64	54.2	18	full_back	club
1.64	64.8	16	full_forward	club
1.65	67.8	21	half_forward	club
1.57	59.8	25	half_back	club
1.65	74.8	40	half_back	club
1.75	78.6	25	half_forward	club
1.62	58.8	19	full_forward	club
1.72	76.9	41	full_forward	club
1.71	62.0	28	half_back	club
1.72	75.4	21	half_back	club
1.69	73.6	42	half_back	club
1.66	68.3	37	full_back	club
1.65	59.6	24	full_forward	club
1.54	35.5	16	full_forward	club
1.65	71.0	32	half_forward	club

1.75	66.0	38	full_back	club
1.75	85.7	36	midfield	club
1.70	68.5	45	half_back	club
1.71	72.6	23	half_forward	club
1.62	64.0	19	half_back	club
1.62	69.4	45	half_back	club
1.64	68.3	30	full_forward	club
1.66	62.7	25	half_forward	club
1.74	76.0	19	full_forward	club
1.78	75.7	19	full_back	club
1.57	60.5	22	half_back	club
1.64	64.9	19	half_back	club
1.71	55.9	19	midfield	club
1.73	65.5	19	midfield	club
1.56	56.5	22	full_forward	club
1.76	69.0	27	midfield	club
1.76	58.7	19	half_forward	club
1.78	74.7	31	midfield	club
1.65	75.5	31	full_back	club
1.74	70.5	31	midfield	club
1.63	66.3	30	half_back	club
1.63	59.7	18	half_back	club
1.63	54.5	20	half_forward	club
1.67	50.5	19	full_back	club
1.80	72.4	31	midfield	club
1.78	72.4	31	half_back	club

1.74	68.2	23	midfield	club
1.61	76.5	19	full_forward	club
1.64	67.1	24	half_back	club
1.70	60.2	27	full_back	club
1.68	75.8	21	full_forward	club
1.66	64.5	25	full_back	club
1.58	58.1	24	half_back	club
1.69	66.1	20	half_forward	club
1.64	55.8	25	half_back	club
1.59	62.8	23	full_forward	club
1.62	70.2	21	full_back	club
1.66	58.8	20	half_forward	club
1.71	71.1	24	full_back	club
1.59	66.2	28	full_back	club
1.61	72.7	29	full_back	club

grade	t_5m_	t_10m_	t_15m_	t_20m_	t_25m_
intermediate_ic	1.14	2.05	2.81	3.56	4.28
senior_ic	1.30	2.07	2.83	3.52	4.20
intermediate_ic	1.21	2.07	2.84	3.58	4.29
intermediate_ic	1.14	1.92	2.61	3.28	3.95
senior_ic	1.13	1.96	2.68	3.39	4.08
senior_ic	1.14	1.96	2.68	3.39	4.07
intermediate_ic	1.11	1.89	2.59	3.26	3.92
senior_ic	1.12	1.90	2.62	3.28	3.94
intermediate_ic	1.10	1.88	2.58	3.24	3.89
intermediate_ic	1.10	1.89	2.59	3.26	3.92
senior_ic	1.10	1.87	2.54	3.19	3.82
intermediate_ic	1.14	1.90	2.59	3.23	3.86
intermediate_ic	1.27	2.14	2.94	3.70	4.46
senior_ic	1.19	2.02	2.75	3.46	4.14
senior_ic	1.07	1.86	2.58	3.26	3.94
intermediate_ic	1.19	2.01	2.73	3.42	4.10
intermediate_ic	1.11	1.92	2.65	3.34	4.01
intermediate_ic	1.12	1.91	2.62	3.31	3.97
intermediate_ic	1.16	1.95	2.67	3.35	4.02
intermediate_ic	1.08	1.87	2.54	3.23	3.88
intermediate_ic	1.12	1.89	2.59	3.27	3.92
intermediate_ic	1.07	1.83	2.53	3.19	3.85
intermediate_ic	1.03	1.80	2.49	3.15	3.80
intermediate_ic	1.17	1.90	2.60	3.24	3.86

senior_ic	1.12	1.91	2.63	3.32	4.00
intermediate_ic	1.14	1.93	2.63	3.29	3.95
intermediate_ic	1.15	1.96	2.68	3.35	4.03
intermediate_ic	1.14	1.98	2.71	3.42	4.11
intermediate_ic	1.17	1.99	2.71	3.42	4.11
intermediate_club	1.16	1.99	2.73	3.44	4.14
senior_club	1.21	2.05	2.79	3.50	4.19
junior_club	1.25	2.14	2.95	3.71	4.48
senior_club	1.12	1.94	2.69	3.41	4.11
junior_club	1.15	1.96	2.68	3.37	4.05
intermediate_club	1.24	2.13	2.92	3.70	4.46
intermediate_club	1.22	2.12	2.92	3.71	4.48
senior_club	1.21	2.06	2.82	3.56	4.28
intermediate_club	1.19	2.02	2.81	3.55	4.30
intermediate_club	1.14	1.99	2.76	3.50	4.23
intermediate_club	1.15	1.96	2.68	3.39	4.09
senior_club	1.17	1.98	2.73	3.44	4.15
intermediate_club	1.06	1.86	2.57	3.26	3.93
senior_club	1.18	1.98	2.66	3.32	3.97
junior_club	1.31	2.22	3.06	3.86	4.64
senior_club	1.14	1.98	2.74	3.47	4.19

junior_club	1.13	1.98	2.76	3.49	4.21
junior_club	1.17	1.99	2.74	3.47	4.19
senior_club	1.11	1.94	2.70	3.43	4.15
junior_club	1.12	1.95	2.70	3.42	4.12
senior_club	1.16	1.96	2.72	3.43	4.14
junior_club	1.15	1.94	2.64	3.34	4.02
junior_club	1.18	2.00	2.75	3.47	4.18
junior_club	1.14	1.96	2.68	3.38	4.06
senior_club	1.26	2.14	2.93	3.70	4.44
senior_club	1.29	2.12	2.91	3.64	4.37
intermediate_club	1.19	2.02	2.75	3.46	4.16

intermediate_club	1.19	2.00	2.73	3.45	4.15
senior_club	1.13	1.96	2.70	3.42	4.11
intermediate_club	1.14	1.94	2.65	3.35	4.02
intermediate_club	1.27	2.08	2.80	3.49	4.16
junior_club	1.21	2.13	2.97	3.78	4.58
junior_club	1.28	2.21	3.05	3.87	4.67
junior_club	1.24	2.13	2.94	3.74	4.52
junior_club	1.23	2.10	2.93	3.72	4.51
junior_club	1.26	2.18	3.00	3.79	4.57
junior_club	1.21	2.11	2.94	3.73	4.51
junior_club	1.29	2.20	3.02	3.80	4.57
junior_club	1.20	2.09	2.91	3.68	4.46
senior_club	1.27	2.13	2.93	3.68	4.43
junior_club	1.17	2.02	2.78	3.56	4.30
junior_club	1.32	2.23	3.04	3.81	4.56
junior_club	1.22	2.05	2.86	3.61	4.34
junior_club	1.20	2.06	2.85	3.60	4.33
junior_club	1.17	2.00	2.76	3.50	4.23
junior_club	1.21	2.04	2.81	3.52	4.23
intermediate_club	1.10	1.93	2.68	3.41	4.11
junior_club	1.2	2.06	2.83	3.55	4.27
junior_club	1.18	2	2.74	3.44	4.13
junior_club	1.15	1.99	2.74	3.45	4.15
senior_club	1.11	1.92	2.64	3.34	4.04

senior_club	1.10	1.92	2.67	3.37	4.06
junior_club	1.16	1.95	2.67	3.38	4.06
junior_club	1.21	2.05	2.78	3.48	4.18
senior_club	1.16	1.97	2.68	3.37	4.05
senior_club	1.08	1.87	2.63	3.33	4.01
junior_club	1.29	2.11	2.85	3.55	4.24
junior_club	1.13	1.93	2.62	3.31	3.98
junior_club	1.19	1.98	2.70	3.38	4.05
senior_club	1.12	1.90	2.62	3.31	3.97
senior_club	1.14	1.93	2.63	3.30	3.96
senior_club	1.03	1.81	2.49	3.14	3.77
senior_club	1.12	1.94	2.65	3.33	3.98
junior_club	1.28	2.19	3.02	3.83	4.65
junior_club	1.21	2.05	2.84	3.57	4.31
senior_club	1.12	1.93	2.66	3.36	4.06
senior_club	1.17	1.98	2.72	3.42	4.10
junior_club	1.14	1.96	2.71	3.39	4.16
junior_club	1.09	1.87	2.56	3.22	3.89
senior_club	1.08	1.86	2.55	3.21	3.85
senior_club	1.12	1.90	2.59	3.24	3.91
junior_club	1.10	1.88	2.59	3.26	3.94
junior_club	1.34	2.18	2.94	3.64	4.34
senior_club	1.10	1.91	2.63	3.33	4.01
junior_club	1.13	1.97	2.73	3.45	4.17
junior_club	1.23	2.09	2.87	3.61	4.35
junior_club	1.26	2.16	3	3.8	4.6

t_30m_	t_35m_	t_40m_	t_mss_	avg_vel_perc_0_10m
5.01	5.79	6.55	6.94	70.3
4.87	5.55	6.22	7.46	64.8
5.01	5.73	6.46	7.04	68.6
4.63	5.33	6.07	7.46	69.8
4.77	5.46	6.17	7.24	70.5
4.77	5.47	6.16	7.35	69.4
4.58	5.25	5.92	7.57	69.9
4.60	5.26	5.90	7.81	67.4
4.54	5.19	5.86	7.69	69.2
4.56	5.21	5.86	7.82	67.7
4.43	5.05	5.67	8.19	65.3
4.49	5.12	5.75	7.93	66.4
5.23	6.02	6.81	6.58	71
4.82	5.49	6.17	7.46	66.4
4.61	5.29	5.98	7.46	72.1
4.77	5.44	6.12	7.46	66.7
4.67	5.33	5.99	7.57	68.8
4.64	5.31	6.00	7.57	69.2
4.68	5.34	6.01	7.57	67.7
4.53	5.18	5.83	7.69	69.5
4.58	5.23	5.91	7.69	68.8
4.51	5.15	5.80	7.81	70
4.44	5.08	5.74	7.82	71
4.49	5.10	5.73	8.19	64.3
4.67	5.34	6.02	7.46	70.2

4.59	5.23	5.87	7.82	66.3
4.70	5.37	6.05	7.46	68.4
4.78	5.48	6.18	7.46	67.7
4.79	5.47	6.16	7.35	68.4
4.85	5.55	6.28	7.15	70.3
4.87	5.56	6.25	7.35	66.4
5.25	6.03	6.86	6.58	71
4.82	5.53	6.24	7.14	72.2
4.72	5.39	6.12	7.46	68.4
5.24	6.05	6.88	6.58	71.4
5.25	6.04	6.85	6.50	72.6
4.99	5.72	6.45	7.04	69
5.04	5.79	6.59	6.75	73.3
4.96	5.69	6.41	6.95	72.3
4.79	5.50	6.22	7.15	71.4
4.87	5.60	6.33	7.04	71.7
4.61	5.30	6.02	7.46	72.1
4.62	5.25	5.89	7.93	63.7
5.44	6.26	7.15	6.41	70.3
4.91	5.64	6.36	6.95	72.7
4.92	5.63	6.34	7.04	71.7
4.90	5.63	6.37	7.04	71.4
4.88	5.60	6.34	6.95	74.2
4.83	5.53	6.27	7.14	71.8
4.86	5.58	6.31	7.04	72.5
4.69	5.36	6.04	7.46	69.1
4.87	5.57	6.27	7.24	69.1
4.74	5.42	6.11	7.35	69.4
5.20	5.95	6.72	6.75	69.2
5.09	5.80	6.51	7.04	67
4.86	5.58	6.32	7.14	69.3
4.85	5.56	6.28	7.15	69.9
4.81	5.51	6.22	7.24	70.5
4.71	5.38	6.07	7.46	69.1

4.84	5.50	6.18	7.57	63.5
5.38	6.19	7.07	6.25	75.1
5.47	6.29	7.12	6.25	72.4
5.30	6.08	6.87	6.41	73.2
5.29	6.08	6.90	6.41	74.3
5.37	6.15	7.01	6.41	71.6
5.28	6.06	6.86	6.49	73
5.35	6.13	6.92	6.49	70
5.23	5.99	6.77	6.58	72.7
5.17	5.93	6.69	6.75	69.6
5.06	5.81	6.58	6.75	73.3
5.32	6.06	6.82	6.75	66.4
5.09	5.84	6.59	6.84	71.3
5.07	5.81	6.59	6.85	70.9
4.95	5.68	6.41	6.95	71.9
4.94	5.65	6.39	7.04	69.6
4.82	5.54	6.27	7.14	72.6
4.98	5.68	6.4	7.15	67.9
4.83	5.53	6.23	7.24	69.1
4.85	5.54	6.23	7.24	69.4
4.72	5.43	6.15	7.35	70.9
4.74	5.42	6.10	7.35	70.9
4.75	5.43	6.13	7.35	69.8
4.87	5.55	6.24	7.35	66.4
4.72	5.39	6.06	7.46	68

4.68	5.36	6.03	7.46	71.7
4.93	5.6	6.28	7.46	63.5
4.64	5.31	5.97	7.57	68.4
4.73	5.39	6.07	7.57	66.7
4.63	5.31	5.97	7.57	69.5
4.60	5.26	5.91	7.82	66.3
4.40	5.02	5.64	8.06	68.5
4.63	5.28	5.90	8.06	64
5.48	6.3	7.14	6.17	74
5.04	5.77	6.51	6.85	71.2
4.75	5.45	6.16	7.24	71.6
4.81	5.49	6.18	7.35	68.7
4.88	5.60	6.33	7.35	69.4
4.54	5.18	5.84	7.82	68.4
4.51	5.16	5.82	7.82	68.8
4.56	5.20	5.87	7.81	67.4
4.62	5.28	5.96	7.57	70.3
5.02	5.7	6.37	7.46	61.5
4.70	5.40	6.09	7.35	71.2
4.88	5.60	6.32	7.04	72.1
5.07	5.80	6.52	6.95	68.8
5.43	6.33	7.37	6.25	74.1

avg_vel_perc_10_20m
95.4
92.4
94.1
98.6
96.6
95.1
96.4
92.8
95.6
93.3
92.5
94.8
97.4
93.1
95.7
95.1
93
94.4
94.4
95.6
94.2
94.1
94.7
91.1
95.1
94
96.4
93.1
95.1
96.5
93.8
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96.8
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97.8
97.3
95.7
94.1
95.1
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94.1
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96.6
95.7
94
95.8
95
93.5
97.3
96.5
94.6
95.1
93.7
97
96.4
96.9
96.3
96.9
95.1
96.3
95.6
95.6
96.2
93.8
93.7
94.8
95.9
96
94.6
93.9
95.9
94.6
95.8
93.8

95.1
95.1
95.7
91.8
93.1
95.7
94.4
93.7
93.3
93.3

89.3
98.8
96
96.6
94.5
95.1
94.7
94.7
95.6
95.7
91.8
95.8
96
94.7
97.6

```
require(tidyverse)
require(effectsize)
require(readxl)

# SETUP DATA
master_data = read_excel("Data_SprintPerformanceFemaleGaelicFootball.xlsx")

master_data = master_data %>% select(-t1_15m_,-t1_25m_,-t1_35m_)

view(master_data)

# COUNTY DATA
County_data = master_data %>% filter(playing_status == "intercounty")

view(County_data)

#CLUB DATA
Club_data = master_data %>% filter(playing_status == "club")

view(Club_data)

#ASSESSING NORMALITY

#COUNTY #COUNTY
#Histograms
County_data_variables = c("height_m","mass_kg", "age","t1_5m_","t1_10m_","t1_20m_","t1_30m_","t1_40m_","t1_mss_","avg_vel_perc_0_10m","avg_vel_perc_10_20m")
purrr::walk(County_data_variables, ~hist(County_data[[.x]], main = paste("Histogram of", .x), xlab = .x))

#QQ_Plot
```

```
purrr::walk(County_data_variables,
        ~{   qqnorm(County_data[[.x]], main = paste("Q-Q Plot of", .x))
qqline(County_data[[.x]], col = "red") })
#Shapiro Wilk
Shapiro_County_results        =        purrr::imap(County_data_variables,~    list(variable      =
.x,       test      = shapiro.test(County_data[[.x]])))
Shapiro_County_results



#CLUB #CLUB
                                                    =
"age","t1_5m_","t1_10m_","t1_20m_","t1_30m_","t1_40m_","t1_mss_","avg_vel_perc_0_10m","av

purrr::walk(Club_data_variables, ~hist(Club_data[[.x]], main = paste("Histogram of", .x), xlab = .x))



        ~{   qqnorm(Club_data[[.x]], main = paste("Q-Q Plot of", .x))
          qqline(Club_data[[.x]], col = "blue") })


                              =    purrr::imap(Club_data_variables,~    list(variable



Club_data_variables                                                        c("height_m","mass_kg",

g_vel_perc_10_20m")


#QQ_Plot
purrr::walk(Club_data_variables,
```

```
#Shapiro Wilk
Shapiro_Club_results = .x, test = shapiro.test(Club_data[[.x]])))
Shapiro_Club_results


# Descriptives of Normally distributed variables (Mass, height, MSS)

County_mean_norm_vars = County_data %>% summarise(across(c(mass_kg, height_m, t1_mss_),mean))
County_mean_norm_vars

County_SD_norm_vars = County_data %>% summarise(across(c(mass_kg, height_m, t1_mss_),sd))
County_SD_norm_vars


Club_mean_norm_vars = Club_data %>% summarise(across(c(mass_kg, height_m, t1_mss_),mean))
Club_mean_norm_vars

Club_SD_norm_vars = Club_data %>% summarise(across(c(mass_kg, height_m, t1_mss_),sd))
Club_SD_norm_vars


# Assessing the Variance of Mass, Height, MSS var.test(County_data$mass_kg, Club_data$mass_kg)
```

```
var.test(County_data$height_m, Club_data$height_m)

var.test(County_data$t1_mss_, Club_data$t1_mss_)


# Independent sample t-test (Mass, height, MSS)
options(scipen = 999) #Presents all the values in decimal format and not scientific notation
Mass_t_test = t.test(County_data$mass_kg, Club_data$mass_kg, alternative = "two.sided", paired =


Height_t_test = t.test(County_data$height_m, Club_data$height_m, alternative = "two.sided", paired =


FALSE, var.equal = TRUE)
Mass_t_test


FALSE, var.equal = TRUE)
Height_t_test

MSS_t_test = t.test(County_data$t1_mss_, Club_data$t1_mss_, alternative = "two.sided", paired =
FALSE, var.equal = TRUE)
MSS_t_test


# Cohen's D ES
t_tests = list(Mass_t_test,Height_t_test,MSS_t_test) ES_t_tests =
lapply(t_tests,effectsize::cohens_d) %>%
purrr::set_names(c("Mass_t_test", "Height_t_test", "MSS_t_test"))
ES_t_tests

# Descriptives (median & IQR)
# (for non-normally distributed variables; age, all sprint times, average velocities 0-10 and 10-20 m)
```

County_median_vars = County_data %>%
summarise(across(c(t1_5m_,t1_10m_,t1_20m_,t1_30m_,t1_40m_,avg_vel_perc_0_10m,avg_vel_per
c_10_20m),median))
County_median_vars

= County_data
summarise(across(c(t1_5m_,t1_10m_,t1_20m_,t1_30m_,t1_40m_,avg_vel_perc_0_10m,avg_vel_per

= Club_data
summarise(across(c(t1_5m_,t1_10m_,t1_20m_,t1_30m_,t1_40m_,avg_vel_perc_0_10m,avg_vel_per

= Club_data
summarise(across(c(t1_5m_,t1_10m_,t1_20m_,t1_30m_,t1_40m_,avg_vel_perc_0_10m,avg_vel_per

County_IQR_vars %>%

c_10_20m),IQR))
County_IQR_vars

Club_median_vars %>%

c_10_20m),median))
Club_median_vars

Club_IQR_vars %>%

c_10_20m),IQR))
Club_IQR_vars

```
# Mann-Whitney U tests
# (for non-normally distributed variables; age, all sprint times, average velocities 0-10 and 10-20 m)

MWU_age = wilcox.test(County_data$age,Club_data$age, paired=FALSE)

MWU_5m = wilcox.test(County_data$t1_5m_,Club_data$t1_5m_, paired=FALSE)

MWU_10m = wilcox.test(County_data$t1_10m_,Club_data$t1_10m_, paired=FALSE)

MWU_20m = wilcox.test(County_data$t1_20m_,Club_data$t1_20m_, paired=FALSE)

MWU_30m = wilcox.test(County_data$t1_30m_,Club_data$t1_30m_, paired=FALSE)

MWU_40m = wilcox.test(County_data$t1_40m_,Club_data$t1_40m_, paired=FALSE)

MWU_0_10m = wilcox.test(County_data$avg_vel_perc_0_10m,Club_data$avg_vel_perc_0_10m,
paired=FALSE)

MWU_10_20m =



# R Effect Sizes for Mann-Whitney U tests
Z_value_age = qnorm(MWU_age$p.value/2)
N_value_age = length(County_data$age) + length(Club_data$age)
r_value_age = abs(Z_value_age)/sqrt(N_value_age)


Z_value_5m = qnorm(MWU_5m$p.value/2)
N_value_5m = length(County_data$t1_5m_) + length(Club_data$t1_5m_)
r_value_5m = abs(Z_value_5m)/sqrt(N_value_5m)



wilcox.test(County_data$avg_vel_perc_10_20m,Club_data$avg_vel_perc_10_20m, paired=FALSE)
```

```
r_value_age

r_value_5m

Z_value_10m = qnorm(MWU_10m$p.value/2)
N_value_10m = length(County_data$t1_10m_) + length(Club_data$t1_10m_)
r_value_10m = abs(Z_value_10m)/sqrt(N_value_10m) r_value_10m

Z_value_20m = qnorm(MWU_20m$p.value/2)
N_value_20m = length(County_data$t1_20m_) + length(Club_data$t1_20m_)
r_value_20m = abs(Z_value_20m)/sqrt(N_value_20m) r_value_20m

Z_value_30m = qnorm(MWU_30m$p.value/2)
N_value_30m = length(County_data$t1_30m_) + length(Club_data$t1_30m_)
r_value_30m = abs(Z_value_30m)/sqrt(N_value_30m)

r_value_30m

Z_value_40m = qnorm(MWU_40m$p.value/2)
N_value_40m = length(County_data$t1_40m_) + length(Club_data$t1_40m_)
r_value_40m = abs(Z_value_40m)/sqrt(N_value_40m) r_value_40m

Z_value_0_10m = qnorm(MWU_0_10m$p.value/2)
N_value_0_10m = length(County_data$avg_vel_perc_0_10m) + length(Club_data$avg_vel_perc_0_10m)
```

```
Z_value_10_20m = qnorm(MWU_10_20m$p.value/2)
                                    =          length(County_data$avg_vel_perc_10_20m)
length(Club_data$avg_vel_perc_10_20m)
r_value_10_20m = abs(Z_value_10_20m)/sqrt(N_value_10_20m)









r_value_0_10m = abs(Z_value_0_10m)/sqrt(N_value_0_10m)
r_value_0_10m


N_value_10_20m                                                                      +


r_value_10_20m





# CLES # CLES # CLES
# d_to_p_superiority(cohen's d)
# rb_to_p_superiority(rb)

#height
d_to_p_superiority(0.14)

#mass
d_to_p_superiority(0.32)
```

```
#MSS
d_to_p_superiority(1.04)


rb_to_p_superiority(r_value_age)

rb_to_p_superiority(r_value_5m)

rb_to_p_superiority(r_value_10m)

rb_to_p_superiority(r_value_20m)

rb_to_p_superiority(r_value_30m)

rb_to_p_superiority(r_value_40m)


# Descriptives for the combined groups #Group #Group #Group
Group_data = rbind(County_data, Club_data) #Combined the two datasets


Group_mean_vars = Group_data %>% summarise(across(c(height_m,mass_kg,t1_mss_),mean))


Group_sd_vars = Group_data %>% summarise(across(c(height_m,mass_kg,t1_mss_),sd))


rb_to_p_superiority(r_value_0_10m)

rb_to_p_superiority(r_value_10_20m)
```

```
# Mean ± SD

Group_mean_vars


Group_sd_vars


# Median & IQR
Group_median_vars = Group_data %>%
summarise(across(c(t1_5m_,t1_10m_,t1_20m_,t1_30m_,t1_40m_,avg_vel_perc_0_10m,avg_vel_per
c_10_20m),median))
Group_median_vars

Group_IQR_vars = Group_data %>%
summarise(across(c(t1_5m_,t1_10m_,t1_20m_,t1_30m_,t1_40m_,avg_vel_perc_0_10m,avg_vel_per
c_10_20m),IQR)) Group_IQR_vars

# Table 2 # Table 2 # Table 2 # Table 2 # Table 2
# Mean ± SD
Group_data$positional_group

Normality_Positional_Group_data = Group_data %>%
group_by(positional_group) %>%   summarise(
  Group_norm_5m = round(shapiro.test(t1_5m_)$p.value,digits=2),
  Group_norm_10m = round(shapiro.test(t1_10m_)$p.value,digits=2),
  Group_norm_20m = round(shapiro.test(t1_20m_)$p.value,digits=2),
  Group_norm_30m = round(shapiro.test(t1_30m_)$p.value,digits=2),
  Group_norm_40m = round(shapiro.test(t1_40m_)$p.value,digits=2),
  Group_norm_MSS = round(shapiro.test(t1_mss_)$p.value,digits=2)
  )
print(Normality_Positional_Group_data)



Group_Positional_norm_data = Group_data %>% group_by(positional_group) %>% summarise(
group_mean_5m = round(mean(t1_5m_),digits=2), group_sd_5m=round(sd(t1_5m_),digits=2),
```

```
group_mean_10m = round(mean(t1_10m_),digits=2), group_sd_10m=round(sd(t1_10m_),digits=2),
group_mean_20m = round(mean(t1_20m_),digits=2), group_sd_20m=round(sd(t1_20m_),digits=2),
group_mean_30m = round(mean(t1_30m_),digits=2), group_sd_30m=round(sd(t1_30m_),digits=2),
group_mean_40m = round(mean(t1_40m_),digits=2), group_sd_40m=round(sd(t1_40m_),digits=2),
group_mean_MSS = round(mean(t1_mss_),digits=2), group_sd_MSS=round(sd(t1_mss_),digits=2))

print(Group_Positional_norm_data)



Group_Positional_NON_norm_data = Group_data %>% group_by(positional_group) %>%
summarise(
  group_median_10m = round(median(t1_10m_),digits=2),
group_IQR_10m=round(IQR(t1_10m_),digits=2),

  group_median_20m = round(median(t1_20m_),digits=2),
group_IQR_20m=round(IQR(t1_20m_),digits=2),
  group_median_30m = round(median(t1_30m_),digits=2),
group_IQR_30m=round(IQR(t1_30m_),digits=2),
  group_median_40m = round(median(t1_40m_),digits=2),
group_IQR_40m=round(IQR(t1_40m_),digits=2),
  group_median_MSS = round(median(t1_mss_),digits=2),
group_IQR_MSS=round(IQR(t1_mss_),digits=2))
```

```
print(positional_NON_norm_data)



Normality_Positional_County_data = County_data %>%
  group_by(positional_group) %>%

    County_norm_5m = round(shapiro.test(t1_5m_)$p.value,digits=2),
    County_norm_10m = round(shapiro.test(t1_10m_)$p.value,digits=2),
    County_norm_20m = round(shapiro.test(t1_20m_)$p.value,digits=2),
    County_norm_30m = round(shapiro.test(t1_30m_)$p.value,digits=2),
    County_norm_40m = round(shapiro.test(t1_40m_)$p.value,digits=2),
    County_norm_MSS = round(shapiro.test(t1_mss_)$p.value,digits=2)
  )
print(Normality_Positional_County_data)


# County Positional Data



  summarise(



County_Positional_norm_data = County_data %>% group_by(positional_group) %>% summarise(
  County_mean_5m = round(mean(t1_5m_),digits=2), County_sd_5m=round(sd(t1_5m_),digits=2),
  County_mean_10m                                              =round(mean(t1_10m_),digits=2),
County_sd_10m=round(sd(t1_10m_),digits=2),
```

County_mean_20m = round(mean(t1_20m_),digits=2),

County_sd_20m=round(sd(t1_20m_),digits=2),

County_mean_30m = round(mean(t1_30m_),digits=2),

County_sd_30m=round(sd(t1_30m_),digits=2),

County_mean_40m = round(mean(t1_40m_),digits=2),
County_sd_40m=round(sd(t1_40m_),digits=2),

County_mean_MSS = round(mean(t1_mss_),digits=2),

County_sd_MSS=round(sd(t1_mss_),digits=2))

view(County_Positional_norm_data)

County_Positional_NON_norm_data = County_data %>% group_by(positional_group) %>%
summarise(
County_median_5m = round(median(t1_5m_),digits=2),

County_IQR_5m=round(IQR(t1_5m_),digits=2),
County_median_10m = round(median(t1_10m_),digits=2),
County_IQR_10m=round(IQR(t1_10m_),digits=2),

=

County_median_20m

County_IQR_20m=round(IQR(t1_20m_),digits=2),

=

County_IQR_30m=round(IQR(t1_30m_),digits=2),

=

County_IQR_40m=round(IQR(t1_40m_),digits=2),

=

County_IQR_MSS=round(IQR(t1_mss_),digits=2))

view(County_Positional_NON_norm_data)

Normality_Positional_Club_data = Club_data %>%

group_by(positional_group) %>%

round(median(t1_20m_),digits=2),

County_median_30m round(median(t1_30m_),digits=2),

```
  County_median_40m round(median(t1_40m_),digits=2),   County_median_MSS

round(median(t1_mss_),digits=2),

# Club Positional Data

summarise(

    Club_norm_5m = round(shapiro.test(t1_5m_)$p.value,digits=2),
    Club_norm_10m = round(shapiro.test(t1_10m_)$p.value,digits=2),
    Club_norm_20m = round(shapiro.test(t1_20m_)$p.value,digits=2),
    Club_norm_30m = round(shapiro.test(t1_30m_)$p.value,digits=2),
    Club_norm_40m = round(shapiro.test(t1_40m_)$p.value,digits=2),
    Club_norm_MSS = round(shapiro.test(t1_mss_)$p.value,digits=2)
  )
view(Normality_Positional_Club_data)

Club_Positional_norm_data = Club_data %>% group_by(positional_group) %>% summarise(
Club_mean_5m = round(mean(t1_5m_),digits=2), Club_sd_5m=round(sd(t1_5m_),digits=2),
  Club_mean_10m = round(mean(t1_10m_),digits=2), Club_sd_10m=round(sd(t1_10m_),digits=2),
  Club_mean_20m = round(mean(t1_20m_),digits=2), Club_sd_20m=round(sd(t1_20m_),digits=2),
  Club_mean_30m = round(mean(t1_30m_),digits=2), Club_sd_30m=round(sd(t1_30m_),digits=2),
  Club_mean_40m = round(mean(t1_40m_),digits=2), Club_sd_40m=round(sd(t1_40m_),digits=2),
Club_mean_MSS = round(mean(t1_mss_),digits=2), Club_sd_MSS=round(sd(t1_mss_),digits=2))
view(Club_Positional_norm_data)

Club_Positional_NON_norm_data = Club_data %>% group_by(positional_group) %>% summarise(
```

```
 Club_median_5m = round(median(t1_5m_),digits=2),
Club_IQR_5m=round(IQR(t1_5m_),digits=2),
 Club_median_10m = round(median(t1_10m_),digits=2),
Club_IQR_10m=round(IQR(t1_10m_),digits=2),
 Club_median_20m = round(median(t1_20m_),digits=2),
Club_IQR_20m=round(IQR(t1_20m_),digits=2),
 Club_median_30m = round(median(t1_30m_),digits=2),
Club_IQR_30m=round(IQR(t1_30m_),digits=2),
 Club_median_40m = round(median(t1_40m_),digits=2),
Club_IQR_40m=round(IQR(t1_40m_),digits=2),
 Club_median_MSS = round(median(t1_mss_),digits=2),
Club_IQR_MSS=round(IQR(t1_mss_),digits=2))
view(Club_Positional_NON_norm_data)
```