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Match performance in a reference futsal team during an international tournament – implications for talent development in soccer

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ABSTRACT: Anecdotal evidence suggests that futsal can aid talent development for 11 a-side soccer through the potential for transfer of the game's skills and constraints. However, additional scientific research is necessary to enhance understanding of the technical and physical demands of futsal and the potential returns for soccer player development. Accordingly, this study examined selected characteristics of physical (internal and external loads) and technical performance in international futsal match-play in order to study the potential of these for skill transfer and aiding soccer player development. Performance was investigated in futsal players (n = 16, 25.74±4.71 years) belonging to a national team during an international tournament. Pre-tournament fitness testing determined maximum heart rate (MHR) via the Yo-Yo IR1 test (194.6±11.1 beats min^{-1}) to aid interpretation of internal load via heart rate measures during match-play. External load (accelerations and deceleration events) was measured using an inertial movement unit. Finally, post-tournament analysis of selected technical events was performed. Results reported a mean heart rate value during 'court time' of 164.7±22.3 beats min^{-1}, which as a percentage of participants' MHR was 87.7%±4.4%, and a mean peak MHR of 98.3±2.5%. Results showed 2.16±0.25 accelerating (>1.5 $m{\cdot}s^{-2}$) and 2.78±0.13 decelerating (>1.5 $m{\cdot}s^{-2}$) events per player per minute. Team statistics included 647 passing, ~51 dribbling and 78 set play events per team per game. Match analyses showed that 77.3% of ball receptions were completed with the sole of the foot. Assessment of two-footedness showed 80.1±16.7% of individual possessions used the dominant foot to receive and 84.1±10.7% to pass the ball thereby displaying strong foot dominance. These results have quantified characteristics of elite futsal match-play that are no doubt intrinsically related to the environmental and task constraints of the sport. In addition to enhancing understanding of futsal, there are potential learning returns and implications for skills transfer and the development of soccer players.

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INTRODUCTION

Futsal is a 5 a-side indoor sport officially recognised by FIFA and UEFA, with an estimated 60 million participants, across 170 countries globally [1, 2]. Similar to soccer, futsal has become a contemporary research area with authors quantifying various physical [3] and technical [4] demands. Researchers are also increasingly discussing the potential of futsal as a talent development tool for soccer [5, 6]. Yet despite some academic [7, 8] and anecdotal evidence of its potential [9, 10], soccer talent development models devote varying training time to integrating futsal possibly due in part to the need for additional evidence-based research [4, 11].

In contrast to futsal, research investigating the contribution that other forms of small sided games (SSG) can have to talent development has arguably received wider coverage in the scientific literature [12, 13]. The benefits of playing reduced format games generally are recognised owing to these condensing the number of skilful actions and decisions participants make, both with and without the ball, whilst constructing realistic match-like conditions in training and preparation for soccer competition [14]. While player learning from SSG can be shaped by the inherent specific constraints that directly affect game demands and subsequent skill

acquisition [15, 16], there is a clear need to further examine futsal game constraints [5].

Recent research on futsal has sought to enhance understanding of the impact of the game's constraints by examining technical skills acquired through participation [7, 17]. The authors utilised modified futsal and soccer tasks (ball, surface and 'individualised playing areas') to observe behaviours, analysing gaze behaviours through the use of a 'mobile eye tracking system' [17], and passing accuracy through task analysis [7]. However, match analyses of technical events in authentic futsal competition are relatively limited [18] notably in elite futsal specific populations [8, 19]. Match-analysis enables researchers to observe and quantify behaviours in real-world settings aiding understanding of authentic play [20]. Authenticity can enhance methodological representative design [21], which is vital in developing impactful outcomes for practitioners [22]. Recent research [8] has examined soccer coach and player perceptions of characteristics of futsal play through observing authentic match-play, with results suggesting futsal participation can develop bipedalism and enhanced ball reception skills. Therefore, on this basis, match-analysis could be used to quantify these technical features during authentic futsal competition providing novel data to depict the characteristics of play as well as responses to coach perceptions of futsal as a potential talent development modality for soccer [8]. This analysis would be informative to soccer practitioners considering whether futsal has potentially transferable technical skills.

Evidence examining physical performance in futsal is more established with a review in 2016 providing a pertinent knowledge base [3]. Research generally reports high-intermittent physical demands experienced by futsal players which are linked to environmental and task constraints with participants performing multiple sprints and changes of direction [23, 24]. Authors have also examined internal load through Heart Rate (HR) responses during match-play and suggest that during on court time, mean HR value ranges are 86–93% [25]. However, when futsal is compared to soccer, a less comprehensive body of scientific evidence examining physical demands is evident [3, 26]. Similarly, studies of SSG are again substantially more common than futsal having comprehensively examined their physical and physiological demands [12]. Further examination of loading in futsal notably at international standards is warranted to support the sport's coaches and practitioners whilst being informative to those in soccer considering futsal physical skills that are potentially transferable to soccer [5, 8]. For example, execution of rapid acceleration and deceleration manoeuvres is a critical part of a soccer player's high-intensity workload [27]. Therefore, identifying alternative means to train and develop these athletic skills is consequently of interest to practitioners.

The aim of this case study was to examine a competitive performance in a national futsal team in a four-team international tournament analysing 1) physical demands using internal and external loading metrics and, 2) components of technical play. It is firstly anticipated that findings will increase knowledge of physical and technical performance in elite futsal. It is also hoped that the results will provide practitioners with pertinent information to help enlighten soccer player development processes through potential learning returns and implications for skills transfer to the 11 a-side version.

METHODOLOGY

Context and Participants

An international futsal tournament was chosen for this case study reflecting the competitive elite nature of participants. Four national teams competed in this tournament with performance data collected on players in a single reference team (n = 16) aged 25.74±4.71 years. Teams were ranked between the top 50–100 teams internationally, with fixtures played at a single venue consecutively over a three-day period. All fixtures were officiated in keeping with the rules for competition set by FIFA, and played on a 20 x 40 m, seamless sprung floor surface suitable for international level futsal. During official futsal matches, duration is actively controlled, with the chronometer only running when the ball is in play with two equal 20 minute halves.

MATERIALS AND METHODS

Data Collection

Ethical approval was granted from the University of Lancashire research ethics committee (Reference number: BAHSS 372) and informed consent was obtained from all participants prior to the commencement of the study. All participants were reassured that their data would remain confidential.

Experimental Design

Pre-Tournament Physical Testing

Fitness testing data was collected during a training camp 1 month prior to the tournament. Participants had a mean body mass of 74.2±9.8 kg and percentage body fat of 11.1±5.8% (estimated using a four-site method [28]). Intermittent high intensity running capacity was determined via the Yo-Yo Intermittent Recovery test (Level 1) [29] and mean performance was 1878±*438 m*. Heart rate was concomitantly recorded using chest worn monitors (Polar, Finland) and the peak value attained by each participant was recorded as their maximum heart rate (MHR). The peak mean heart rate across the group was 194.6±11.1 beats min^{-1} (beats per minute).

Match Analysis

During analysis of internal and external load measures game time was measured using a chronometer which ran from the commencement to the completion of each half. Across the three games, a mean total chronological game time of 1:20:52±4:50 was recorded as opposed to the 40 minutes of active (effective) playing time used in futsal. To obtain data for both internal (heart rate) and external load measures based solely on *'court time'* all data was filtered to exclude any time players were on the bench as substitutes as well as time-outs, and the half time break.

Physical Performance

Heart rate was used to measure internal load responses to competition and was recorded using the Team Polar system (Polar, Finland). Peak heart rate was the highest value achieved during match-play. External load was measured using inertial movement units (IMU) (Optimeye S5 devices, Catapult Sports) which incorporate an accelerometer, gyroscope and magnetometer all sampling at 100 Hz. During competition each player systematically wore the same IMU harnessed securely between the scapulae. Propriety software (Catapult Sprint, version 5.1) filtered the raw data using Kalman techniques and quantifies specific micro-movements referred to as Inertial Movements Analysis (IMA). IMA acceleration and deceleration events were segregated into four categories defined by the manufacturer's software; Low (1.5–2.5 $m \cdot s^2$), Medium (2.5–3.5 $m \cdot s^2$), High (>3.5 $m \cdot s^2$), and Total (>1.5 $m \cdot s^2$). During indoor court-based training sessions, IMA counts demonstrated good reliability (CV 1.8–2.1%, SWD 2.5%) suggesting this variable is sensitive to real differences in performance [30]. As a global measure of external load, Player Load (PL, presented in arbitrary units) was reported which is a modified vector magnitude expressed as the square root of the sum of instantaneous rate of acceleration in each vector (X, Y and Z axes) divided by 100. PL is also presented as PlayerLoad per minute ($PL \cdot min^{-1}$). PlayerLoad (PL) and PlayerLoad per minute (PL·min-1) are shown to be reliable indicators of global external load (CV 0.9%, SWD 0.8–1.1%) [30, 31].

Technical performance

To select relevant technical variables for analysis, two international futsal coaches were consulted following a review of related literature in soccer [32, 33], and futsal [18, 34]. Operational definitions are provided in the appendices. Data was generated using the SportsCode software package (v.11.2.15, Hudl, Lincoln, NE, United States).

Data Analysis

Data are presented as mean±SD unless otherwise stated. Effect sizes (ES) were calculated to compare selected the frequencies of performance measures including ball receptions using sole of foot vs 'other' foot regions; left vs right foot receptions; dominant foot vs non-dominant foot receptions; accelerations vs decelerations using Cohen's *d* (and 95% confidence intervals, CI) to determine the magnitude of differences in mean values [35, 36]. The ES magnitudes were classified as trivial (<0.2), small (>0.2–0.6), moderate (>0.6–1.2), and large (>1.2).

RESULTS

Table 1 presents data on total chronological game time (1:20:52±*4:50*) and internal workload measures (heart rate) of performance for the reference futsal team. Across the three matches, internal loading measures show a mean HR value of 164.77 beats min-1 (±*22.30*), which, in relation to values obtained during the Yo-Yo Intermittent Recovery test (Level 1) equates to a mean heart rate max percentage (MHR%) of 87.69%±*4.44*%). Mean peak MHR values of 98.30%±*2.47*% can be observed across the tournament.

Table 2 presents data collected on external loading measures of performance. Results suggest that players performed, on average, 2.16±0.25 accelerations per minute, of which the most frequent type was actions at 1.5–2.5 $m \cdot s^{-2}$ (1.32±0.10 per minute), followed by 2.5–3.5 $m \cdot s^{-2}$ (0.51±0.09 per minute) and >3.5 $m \cdot s^{-2}$ (0.33±0.09 per minute). Analysis of decelerations showed that players performed on average 2.78±*0.*13 actions per minute with the most frequent being 1.5–2.5 $m \cdot s^{-2}$ (1.64±0.13 per minute), followed by 2.5–3.5 $m \cdot s^{-2}$ (0.72±0.04 per minute) and >3.5 $m \cdot s^{-2}$ (0.43±0.13 per minute). Effect sizes comparing the frequency of accelerations versus decelerations reported a large difference for 'total' events per minute (>1.5 $m \cdot s^{-2}$) (d = 3.11, CI = 2.93, 3.21) and large differences specifically for 'high' (>3.5 $m \cdot s^{-2}$) events per minute (d = 1.56, CI = 1.43, 1.65).

Table 3 presents data collected on ball reception techniques. Analysis showed players utilised the sole of the foot more often (total = 1279±20.08, 77.26%) in comparison to other regions of the foot such as the instep (total = 343±5.02, 22.74%). Effect sizes were calculated for frequency of reception types for sole vs others with a *large* difference reported (*d* = 1.78, CI = 1.67, 1.85),

TABLE 1. Internal workload measures in a reference futsal team during international tournament match play (mean ± SD)

Variables	Match 1	Match 2	Match 3	Total
Total Chronological Game Time	01:21:43 mins	01:15:40 mins	01:25:13 mins	01:20:52 mins
Heart Rate *During Court Time** **(beats min $^{-1}$)**	167.9 ± 21.3	168.5 ± 18.7	158.1 ± 25.1	164.8 ± 22.3
Heart Rate *During Court Time** ***(%* maximum heart rate)**	88.7% ± 3.8%	88.3% ± 4.0%	85.0% ± 7.1%	87.7% ± 4.4%
Peak Heart Rate *During Court Time** **(% maximum heart rate)**	99.3% ± 2.2%	97.9% ± 2.7%	97.3% ± 2.9%	98.3% ± 2.5%

*Data collected per minute of 'court time' filtered to exclude half time, bench time and time outs.

TABLE 2. External workload measures in a reference futsal team during international tournament match play (mean ± SD).

Variables	Match 1	Match 2	Match 3	Total
External measures – IMA*				
Low Acceleration – Events per min	1.21 ± 0.24	1.35 ± 0.44	1.41 ± 0.37	1.32 ± 0.10
Medium Acceleration – Events per min	0.44 ± 0.15	0.62 ± 0.46	0.46 ± 0.24	0.51 ± 0.09
High Acceleration – Events per min	0.24 ± 0.13	0.43 ± 0.25	0.32 ± 0.19	0.33 ± 0.09
Total per min	1.90 ± 0.06	2.39 ± 0.12	2.19 ± 0.09	2.16 ± 0.25
External Measures – IMA*				
Low Decelerations – Events per min	1.73 ± 0.32	1.49 ± 0.36	1.70 ± 0.46	1.64 ± 0.13
Medium Deceleration – Events per min	0.76 ± 0.15	0.73 ± 0.20	0.68 ± 0.19	0.72 ± 0.04
High Deceleration – Events per min	0.42 ± 0.27	0.43 ± 0.27	0.43 ± 0.14	0.43 ± 0.01
Total per min	2.91 ± 0.09	2.65 ± 0.08	2.80 ± 0.17	2.78 ± 0.13
Mean Player Load (AU)^	253.5 ± 74.3	330.1 ± 44.7	330.1 ± 44.7	296.2 ± 68.2
Mean Player Load ·min-1 (AU)^	12.0 ± 0.87	11.5 ±1.44	11.5 ±1.44	11.9 ± 1.10

*Data collected per minute of 'court time' filtered to exclude half time, bench time and time outs.

^ Player load is reported as Arbitrary Units (AU).

and the percentage difference also showing a *large* difference (d = 4.42, CI = 4.23, 4.51). The mean frequency of receptions was collated with 16.06±19.00 per player using the left foot versus 29.22±17.82 events per player using the right foot across all three games (*moderate* difference, d = 0.71, CI = 0.63, 0.79). When considering individual players' foot dominance as a percentage of these ball receptions, 80.11% occurred utilising the dominant foot compared to 19.89% using the non-dominant foot (*large* difference, d = 3.62, CI = 3.45, 3.70).

Table 4 presents data analysing passing during match-play. Means were calculated for foot dominance, with left footed players passing with their dominant foot on 76.56% of occasions whilst similarly right-footed players passed with their dominant foot 87.47%, with a combined total of 84.13% passes made using the dominant foot, compared to 15.87% with the weaker foot. Effect sizes for passing between groups (dominant vs non-dominant foot) showed a *large* difference (d = 6.36, CI = 6.10, 6.48) towards preference towards the use of players' dominant foot. Pass completion was also compared between dominant (89.69%) versus non-dominant foot (84.28%) showing *moderate* differences (d = 0.83, CI = 0.74, 0.90).

Finally mean values across the three games for selected defending and attacking actions are displayed in Table 5.

DISCUSSION

The aim of this case study was to investigate performance in an national futsal team during an international tournament, analysing physical (using internal and external loading metrics) and technical elements of play. Results of the physical analysis reported high mean heart rate values during court time (164.77±22.30 beats $min^{-1)}$, which as a percentage of participants' MHR was 87.69%±4.44%, with mean peak MHR of 98.30±2.47%. Meanwhile results showed 2.16±0.25 accelerating (>1.5 $m{\cdot}s^{-2}$) and 2.78±0.13 decelerating (>1.5 $m{\cdot}s^{-2}$) events per minute. Post tournament match analyses showed that the majority of ball receptions (77.26%) were completed with the sole of the foot. Assessment of two-footedness showed 80.11±16.65% of individual possessions used the dominant foot to receive and 84.13±10.74% to pass the ball thereby displaying strong foot dominance. These results quantify game characteristics of futsal enhancing existing knowledge of the sport as well as having potential implications for skills transfer and talent development in soccer.

Physical performance

Research shows that futsal is a high intensity intermittent sport requiring repetition of intense physical actions [26]. These physical demands are directly related to the environmental and task constraints of the game and are explored in this section.

Heart Rate

The present results report a mean heart rate of ~165 beats min^{-1} across players during *'court time'* over the whole tournament approaching values reported in previous futsal research (mean = 174 beats min^{-1} [25]). When considering present values as a percentage of their maximum heart rate (MHR) players showed a mean value of ~88%. Comparable research reports similar mean MHR values of ~90%, also based on *'court time'* [25]. As activity showing values >80% MHR [37] should be considered *'very vigorous'*, the present data reflect the high intensity nature of futsal when *'on-court'* and the high fitness levels required [23, 26]. Furthermore, results show a mean peak MHR of ~98% during *'court time'* again reflecting the intense nature of futsal. When compared to other SSG, 5v5 soccer produced mean MHR % ranges of 82–87% suggesting futsal may be towards the upper limit of ranges found in SSG [38–40].

TABLE 3. Analysis of ball receptions in a reference futsal team during international tournament match play (mean ± SD).

Ball receptions	Match 1	Match 2	Match 3	Total
Total sole of the foot receptions	**420** ± *19*	**408** ± *14*	**451** ± *26*	**1279** ± *20*
Percentage sole of the foot receptions	**75.73%** ± *10.66*	**73.31**% ± *12.71*	**82.76%** ± *12.53*	**77.26%** ± *12.34*
Total other part of the foot	**120** ± *4.24*	**135** ± *4.39*	**88** ± *5.84*	**343** ± *5.02*
Percentage other part of the foot	**24.27%** ± *10.66*	**26.69**% ± *12.71*	**17.24%** ± *12.53*	**22.74%** ± *12.34*
Total dominant foot receptions	**81.09%** ± *16.83*	**80.95%** ± *12.39*	**79.86%** ± *21.30*	**80.11%** ± *16.65*
Total non-dominant foot receptions	**18.91%** ± *16.83*	**19.05%** ± *12.39*	**20.14%** ± *21.30*	**19.89%** ± *16.65*

TABLE 4. Analysis of passing frequency in a reference futsal team during international tournament match play (mean ± SD).

Passing	Match 1	Match 2	Match 3	Total
Total number of passes in reference team	646	658	636	646.7 ± 11.0
Mean number of passes per player	53.8 ± 25.7	54.8 ± 18.7	53.0 ± 34.8	53.9 ± 26.4
Total number of left foot passes	268.0 ± 26.9	247.0 ± 24.7	193.0 ± 21.8	708.0 ± 24.0
Total number of right foot passes	378.0 ± 20.4	411.0 ± 21.1	443.0 ± 31.1	1232.0 ± 24.1
Left foot dominant players passing using left foot	77.8% ± 13.4	78.6% ± 13.7	72.3% ± 22.9	76.6% ± 14.9
Right foot dominant players passing using right foot	86.7% ± 6.56	86.7% ± 5.6	88.9% ± 6.6	87.5% ± 6.1
Total percentage of dominant foot passes	82.2% ± 9.77	84.0% ± 9.3	84.7% ± 13.6	84.1% ± 10.7
Total percentage of non-dominant foot passes	17.8% ± 9.77	16.0% ± 9.3	15.3% ± 13.6	15.9% ± 10.7
Percentage of successful passes using dominant foot	89.6% ± 5.38	89.4% ± 6.0	90.0% ± 8.4	89.7% ± 6.5
Percentage of successful passes using non-dominant foot	88.q% ± 35.8	77.5% ± 18.1	87.5% ± 21.2	84.3% ± 18.2

However, variable pitch sizes, playing surfaces, and player numbers are utilised in SSG based study designs rendering direct comparisons a challenge [12]. Comparable data in soccer has shown mean MHR values at ~85% and peak MHR values ~98% [41], signifying comparable internal loads to futsal, reflecting the high intensity, intermittent nature of both sports [3, 24]. Thus, with equivalent profiles to soccer, futsal represents along with SSG, an alternative and valid method to train soccer players physically, which is relevant for practitioners considering futsal as a developmental tool.

IMU Analysis

To our knowledge, this paper is the first to quantify the external load demands of international competitive futsal using IMU. While sprinting is an important element of soccer [42], in futsal the capacity to accelerate over short distances is potentially of greater significance given the limited playing area dimensions [26]. During the present tournament, players performed, on average 2.2 accelerations per minute, of which the most frequent was 1.5–2.5 $m{\cdot}s^{-2}$ (1.3/min), followed by 2.5–3.5 $m{\cdot}s^{-2}$ (0.5/min) and >3.5 $m{\cdot}s^{-2}$ (0.3/min). In the absence of similar data from futsal, it is difficult to interpret these data, but results nevertheless highlight that the capacity to regularly change speed by accelerating is essential during match-play. The frequency of high accelerations performed per minute here is within the range of range 0.2–0.4 per minute previously reported for soccer [27]. Decelerations were also analysed with players performing on average 2.8 actions per minute with most frequent 1.5–2.5 $m{\cdot}s^{-2}$ (1.6), followed by 2.5–3.5 $m{\cdot}s^{-2}$ (0.7) and >3.5 $m{\cdot}s^{-2}$ (0.4). Thus, players decelerated more frequently than they accelerated a finding which reflects deceleration versus acceleration demands reported in a recent review of 11 a-side soccer demands [27]. While, further research including a greater number of teams is warranted, futsal participation would it seems from a soccer athletic development perspective, able to provide a pertinent means to train acceleration and deceleration ability for 11 aside soccer.

TABLE 5. Analysis of defending and attacking actions of a futsal team during international tournament match play (mean ± SD).

Variable	Match 1	Match 2	Match 3	Mean
Defending – interceptions	47	57	29	44.3 ± 14.2
Defending – tackles/blocks	50	58	47	51.7 ± 5.7
Dribble – successful	29	44	45	39.3 ± 8.96
Dribble – unsuccessful	9	10	16	11.7 ± 3.79
Goals	9	16	2	9.00 ± 7.00
Headers	6	12	6	8.00 ± 3.46
Set – corners	7	21	13	13.6 ± 2.89
Set – free kicks	6	6	7	6.33 ± 0.58
Set – GK goal-kick/throw-in	17	12	12	13.6 ± 2.89
Set – Kick-ins	56	38	55	49.7 ± 10.1
Set – Successful COS	6	13	11	10.0 ± 3.61
Set penalties	2	3	0	1.67 ± 1.53
Shots off target	13	17	17	15.7 ± 2.31
Shots on target	25	49	17	30.3 ± 16.7
Toe shots	2	8	1	3.67 ± 3.79

TECHNICAL PERFORMANCE

Ball receptions

Futsal task constraints, and notably the interaction between the playing surface and the weighted ball [43] is associated with specific ball reception skills [6]. To our knowledge, this is the first-time research has quantified ball reception types during authentic elite futsal match-play. The results suggest that a high proportion of ball receptions are completed utilising the sole of the foot (~77%), a characteristic developed due to unique futsal task constraints of both the surface and ball. This result may, in part, support previous research, which assessed player scanning behaviours concluding that futsal participation develops attention orientation as a consequence of the interaction between the ball and the surface [17]. This research [17] suggested that perceptual skills are developed through futsal, with participants' using scanning behaviours immediately prior to, and upon ball reception. Skill acquisition through futsal practice especially during ball reception events could therefore have potential for developing enhanced spatial orientation and perceptual-motor skills as a consequence of task constraints with positive consequences for skill acquisition.

Bipedalism

Previous research has suggested that the task constraints inherent to futsal practice could promote technical proficiency [6]. Indeed, a recent survey of elite soccer coaches' perceptions showed that they believed that futsal develops multifunctional players capable of performing a multitude of different technical actions associated with bipedalism [8]. Results here suggest that a high proportion of players used their dominant foot to receive (~80%) and pass the ball (~84%). Thus, it seems that bipedalism was not evident here, which is similar to limited, but comparable research in soccer [44]. In this latter study, analysis of play in the 1998 soccer World Cup reported dominant foot 'touches' ranging from ~82–84%, outlining foot dominance. However, it is noteworthy that one of the present futsal participants showed anomalous data in ball receptions (dominant foot = ~34%, non-dominant foot = ~66%) and passing (dominant foot = ~56%, non-dominant foot = ~44%) with his unique practice history a possible causal factor. Indeed, this particular participant had a significant amount of futsal specific practice in a South American country where futsal and soccer are often 'twin tracked' [11] potentially developing enhanced bipedalism. Further to futsal exposure during youth, as an experienced futsal international, ~12 years of domain specific practice (substantially more than other players in the present reference team) had been accumulated at elite level. We speculate this domain specific practice enhanced these skills, alongside contextual variables (individuality, stature & position), potentially explaining the individual uniqueness in the player's data, and also the lack of bipedalism observed in other participants. Further holistic research in 'pure' futsal players is necessary to examine the impact of longitudinal domain specific practice.

Team Statistics

One of the most remarkable elements of futsal pertains to the ability of players to perform dribbles and 'take on' opponents [45] and this creativity is a skill often revered by practitioners and spectators [46]. The present analysis showed a mean of ~51 dribbles, (~39 successful and ~12 unsuccessful dribbles) per team per game. In contrast, previous futsal research in Brazil [45] reported data in 30 adult players reported a mean average of 12 successful dribbles and ~7 unsuccessful dribbles per futsal game. The lower number of dribbles reported could be explained by the reduced pitch dimensions used in

the Brazilian study (18x30m) compared to FIFA approved pitch dimensions used here (20x40m) [45]. Analysis of technical demands in various small-sided soccer games [47] showed when normalised per team and over 40minutes (futsal game time) a mean of ~31 dribbles, a value again lower than present values (~38). Again, caution is necessary due to methodological differences, with the small-sided paper using a larger 46mx40m pitch and played on grass. Further research should consider pitch dimensions and age appropriate constraints when performing analysis along with the contextual variables of the level and context of the game, which may produce decision making to limit risk during meaningful games (championship finals). However, research does suggest an association between technical skills and success in soccer with superior dribbling in youth correlating with high achievement in adulthood [48], highlighting the importance of developing these skills. As such, futsal may facilitate the development of dribbling skills due to game constraints, notably the balls' interaction with the surface, which could be useful when considering long-term player development [49].

Passing is also a factor which characterizes team sports such as futsal [50] and is considered a complex perceptual-motor skill. Futsal players must combine reception and passing skills during dynamic match-play with the pitch markings/boundaries impacting upon playing behaviours [7]. The present data reported relatively high amounts of passes per team: ~647 (~54 actions per player). Data also shows completion rates with a successful pass percentage of ~90% using the dominant foot, and ~84% using the non-dominant foot, which is relatively comparable to previous research in futsal showing ~90% successful passes albeit without distinguishing foot dominance [50]. Comparatively elite soccer data shows a lower figure of ~76% success rate in passing actions [51] although data evidently includes longer (and potentially more difficult) passes, a key characteristic of soccer. The present data may support the perceptions of coaches in recent survey-based research who suggested that passing accuracy is a key skill that can be enhanced through futsal practice owing to the game's constraints [8]. This result is of potential interest to researchers interested in skill acquisition in futsal and the possible transfer of such actions to soccer. Indeed, preliminary investigations using domain specific tasks (soccer and futsal) found that futsal players positively transferred their passing skills to a soccer game and performed more accurate passes than the soccer group suggesting positive transfer between futsal and soccer regarding passing actions [7, 52]. The implications of increased evidence supporting skills transfer between futsal and soccer could lead to a greater inclusion of futsal, and its constraints, in soccer talent development programs. Indeed, the contemporary trends in soccer are possibly showing closer alignment to futsal match behaviours with a 7-year evolution in the English Premier league (EPL) notably showing increases in technical actions such as the number of passes (notably played over shorter and medium distances) and pass success rates [53].

Finally, results show that in addition to passing, the impact which game constraints, including boundaries, also influenced the occurrence of set-play events. Match analysis reported frequencies of set-plays per team per game including kick-ins (~43), corners (~10), penalties (~1.33), goalkeeper restarts (~17), free-kicks (~6) and set pieces resulting in the creation of a shot (~8). These data shows that, overall, set-plays are more frequent in elite futsal compared to soccer competition, with teams in the latter recording an average of 17 throw-ins, 5 corner-kicks and 14 free kicks per match [20]. The differences in free kicks might possibly be explained by the laws of futsal with punishments for teams accumulating fouls. Futsal may it seems provide participants with opportunities to practice and develop certain set piece skills (e.g., ball delivery, movement off the ball) or choreographed routines enhancing development of this aspect of play.

Limitations and recommendations

It is important to mention that despite playing for a national futsal team, many of the present players had both futsal and soccer practice histories, thereby futsal skill-specific characteristics could to a certain extent be limited. A previous paper analysed 82 participants from soccer and futsal, concluding that most futsal subjects used were *'failed footballers'* neglecting to show domain-specific characteristics [54]. To build on the present data and more representative differences between futsal and soccer, there is a need to study futsal specific populations, and notably full-time professional futsal players. Meanwhile, research comparing rankings of countries in both sports concluded a positive correlation exists between success in futsal and soccer, suggesting a twin-tracked philosophy in those countries [11], presenting a challenge to researchers seeking to examine domain-specific sample groups. A further potential limitation is the standard of the present participating teams. Although international level was used, research has shown that higher ranking futsal teams play differently both collectively and individually [50, 55], which could be a limiting factor to the generalisability of behaviours observed in this piece. Also, despite the advantages of case study type research [56], future papers could seek to compare additional and larger populations, over more matches and greater durations. Contemporary local indoor positioning technologies would allow collection of a wider range of work load variables, facilitating comparisons with outdoor play. Finally, with this paper identifying common behaviours in futsal play, future research should seek to examine further the transferal of specific skills such as ball reception abilities to soccer. Research would complement existing evidence [7] and inform contemporary debates in this regard [5, 6, 8].

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APPENDIX 1

Action	Variable	Definition
Finishing	**Shot – On Target (Successful)**	*An attempt to goal which required intervention to stop it going in or resulted in a goal/shot which would go in without being diverted.*
	Shot – Off Target (Unsuccessful)	*An attempt to score a goal, which did not require an intervention to stop it going in, and would not score a goal without an external influence.*
Possession	**Passing – Successful**	*An intentional played ball from a player to their teammate which retains possession for the team.*
	Passing – Unsuccessful	*An intentional pass which results in the loss of possession for the team.*
	Passing Accuracy	*Pass Accuracy (%): a ratio calculated from successful passes divided by all passes.*
Dribbling/Ball Manipulation	**Dribbling – Successful**	*A dribble is an attempt by a player to beat an opponent in possession of the ball. A successful dribble means the player beats the defender while retaining possession, to gain space or an angle, including ball manipulations and turns.*
	Dribbling – Unsuccessful	*The dribbler is tackled by an opponent or loses possession of the ball, including running the ball out of play.*
Headers	**Headers – Any**	*Any occasion where an individual competes for or receives a ball in the air, which results in the ball touching a player's head.*
Defending – Possessions Gained	**Tackles, Interceptions and Blocks**	*The act of gaining possession from an opposition player who is in possession of the ball through a tackle or intercepting a pass.*
Goals	**Goals**	*Any goal*

Adapted from: Liu H, Gómez M, Gonçalves B, Sampaio J. Technical performance and match-to-match variation in elite football teams. J Sports Sci. 2016;34(6):509–18

Futsal Specific Skills

Action	Variable	Definition
Ball Reception	**Reception using Instep of Foot – Left**	*When a player receives the ball using their **left** foot utilising any part of the foot, other than their sole.*
	Reception using Instep of Foot – Right	*When a player receives the ball using their **right** foot utilising any part of the foot, other than their sole*
	Sole of the Foot – Left	*When a player receives the ball using their **left** foot utilising their **sole.***
	Sole of the Foot – Right	*When a player receives the ball using their **right** foot utilising their **sole.***
Set Pieces	**Kick – Ins**	*Any occasion when the ball goes off the pitch and results in a kick in from an outfield player.*
	Kick Ins – Successful (Creation of a shot)	*Any occasion when the ball goes off the pitch and results in a kick in from an outfield player, which results in a shot (on or off target) within 3 passes.*
	Corners	*Any occasion where the officials allocate a corner kick to be taken.*
	Free Kicks	*Any infringement committed by a player that is penalised as foul play by the referee and results in a free kick.*
Finishing	**Shot using the Toe**	*Any shot towards goal which uses the toes on the player's foot.*

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