

1 **THE EFFECTS OF A COMPETITIVE SOCCER MATCH ON JUMP**
2 **PERFORMANCE AND INTER-LIMB ASYMMETRIES IN ELITE**
3 **ACADEMY SOCCER PLAYERS**

4
5 **ABSTRACT**

6 The purpose of the present study was to investigate the effects of a competitive soccer match on jump
7 performance and inter-limb asymmetries over incremental time points during a 72-hour (h) period.
8 Fourteen elite adolescent players from a professional English category three academy performed single
9 leg countermovement jumps (SLCMJ) pre, post, 24, 48, and 72-h post-match on a single force platform.
10 Eccentric impulse, concentric impulse, peak propulsive force, jump height, peak landing force, and
11 landing impulse were monitored throughout. Inter-limb asymmetries were also calculated for each
12 metric as the percentage difference between limbs. Significant negative changes ($p < 0.05$) in jump
13 performance were noted for all metrics at all time points, with the exception of jump height. Inter-limb
14 asymmetries were metric-dependent and showed very large increases, specifically post-match, with a
15 trend to reduce back towards baseline values at the 48-h time point for propulsive-based metrics.
16 Asymmetries for landing metrics did not peak until the 24-h time point and again reduced towards
17 baseline at 48-h. The present study highlights the importance of monitoring distinct jump metrics, as
18 jump height alone was not sensitive enough to show significant changes in jump performance. However,
19 inter-limb asymmetries were sensitive to fatigue with very large increases post-match. More frequent
20 monitoring of asymmetries could enable practitioners to determine whether existing imbalances are also
21 associated with reductions in physical performance or increased injury risk.

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23 **Key Words:** Performance monitoring, imbalances, recovery

26 **INTRODUCTION**

27 During match play, soccer athletes are required to perform repeated high intensity, intermittent, and
28 multi-directional actions in unpredictable environments. Specifically, jogging, sprinting, jumping, and
29 changes of direction are common in soccer which frequently require high levels of unilateral force
30 production (3,32,37). Mohr et al. (33) documented approximately 1300 individual or combinations of
31 these actions throughout match-play, which have been shown to occur and subsequently change on
32 average every five seconds. With players consistently required to perform these actions and react to
33 external stimuli such as opponents and ball trajectory to name just a couple, asymmetrical loading is a
34 natural consequence; thus, inter-limb asymmetries are likely a by-product of the sport which has been
35 shown in comparable team sport athletes (23). In addition, the action of kicking is also likely to
36 contribute to inter-limb differences in soccer players due to the inherent nature of the non-kicking limb
37 required to stabilize each player (and thus absorb ground reaction force) during the action itself.
38 Furthermore, inter-limb asymmetries have been negatively associated with sports performance markers
39 (6,9,25,31), in addition to increased injury risk about the hip (5), knee (14) and ankle (18). Thus,
40 quantifying and monitoring changes in asymmetry could be deemed important to both maximize
41 physical performance and reduce potential injury risk.

42 The relationship between fatigue and physical performance has been found increasingly important as
43 reduced physical performance inclusive of: total distance covered, high speed running, sprint distance,
44 accelerations, and decelerations (1,45) have also been noted during the latter periods of each half.
45 Chronic effects of neuromuscular fatigue have also been shown to remain up to 48 hours post-match
46 (2,27,44). Within the available literature, simulated match protocols have been utilized to induce player
47 fatigue and monitor both their acute and chronic effects on performance. Significant intra-limb
48 decreases of 13-15% in functional hamstrings to quadriceps strength ratio (H:Q) have been shown
49 following the Loughborough intermittent shuttle test and a soccer-specific aerobic field test,
50 respectively (10,43). Soccer players are generally involved in > 70 matches per season with ~3-6
51 training sessions every week, leaving little time for recovery (27,41). Thus, the time course of residual

52 periods where elevated asymmetry may be present also requires examination to inform training
53 prescription and identify vulnerable periods where players may be at a greater risk of injury.

54 Previous studies have focused on the use of isokinetic dynamometry to measure inter-limb asymmetries
55 (14,16,43). Although useful, isokinetic assessments involve isolated joint actions under the constraints
56 of laboratory conditions and are likely to be time-inefficient in comparison to alternative field-based
57 tests. More recent investigations have highlighted the use of unilateral jump tests to quantify
58 asymmetries in soccer players such as the single leg countermovement jump (SLCMJ) and various hop
59 tests (9). Bishop et al. (9) reported jump height asymmetries of ~12% in youth female players from the
60 SLCMJ, which were double that of any horizontal hop tests. Furthermore, these inter-limb differences
61 were associated with reduced sprint ($r = 0.49$ to 0.59) and jump performance ($r = -0.47$ to -0.58)
62 suggesting that players with smaller asymmetries outperformed those with larger differences. However,
63 test protocols in the aforementioned study were performed when players were fresh. At present, the
64 association between side-to-side differences and fatigue in soccer is particularly scarce with studies
65 only using simulated protocols to induce fatigue (10,16,29,43). These protocols exclude the auxiliary
66 actions synonymous with soccer (such as physical duels); thus, not providing a true representation of
67 the demands of competitive match-play.

68 Therefore, the first aim of the present study was to quantify inter-limb asymmetries in a cohort of elite
69 academy soccer players. The second aim was to determine the effects that a competitive soccer match
70 has on these side-to-side differences. The final aim was to monitor these asymmetries over a 72-h
71 period, which would provide an insight into the relationship between asymmetries, fatigue, and
72 recovery. It was hypothesized that asymmetries would significantly increase post-match with notable
73 reductions seen throughout the 72-h recovery period.

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78 **METHODS**

79 **Experimental Approach to the Problem**

80 This study examined the acute effects of a single 90-minute soccer match during the in-season period
81 on inter-limb asymmetries in elite male youth soccer players throughout a 72-h time period.
82 Asymmetries were measured using the SLCMJ with all testing conducted on a uniaxial force platform.
83 The SLCMJ had been included in previous strength and conditioning programs bi-weekly for up to six
84 weeks pre-testing, ensuring that all players were fully familiar with the testing protocols. In addition, a
85 complete simulated familiarization session was carried out seven days prior to the experimental trial.
86 Assessments were conducted at scheduled intervals: two hours pre-match, one hour post-match and 24-
87 h, 48-h, and 72-h post-match. To limit external influences, subjects were asked to maintain regular diet
88 and sleeping habits throughout the duration of the study, (details of which were previously provided to
89 players as part of the club's in-house player development program). Within-session reliability was
90 computed three ways at each time point, noting that reliability of some force platform metrics have been
91 affected when athletes are in a fatigued state (21).

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93 **Subjects**

94 Fourteen elite adolescent male soccer players (age: 17.6 ± 0.5 yr; body mass: 63.2 ± 6.7 kg; height: 1.77
95 ± 0.8 m) from a professional English category three academy volunteered to participate in this study.
96 All subjects were regularly completing six hours of technical soccer training and three hours of
97 supplementary strength and conditioning training per week. All subjects had a minimum soccer specific
98 and resistance training age of two years. All participants were free from injury and illness at the time of
99 testing and for the duration of the study period. Parental and participant consent was obtained prior to
100 commencement of the study owing to the participant age and ethical approval was granted from the
101 appropriate institutional review board.

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103 **Procedures**

104 *Single Leg Countermovement Jumps (SLCMJ).*

105 Participants stood on the center of a force plate (400 series performance force plate; Fitness Technology,
106 Australia) operating at 600 Hz, motionless for 2-seconds enabling their system mass to be calculated.
107 Upon instruction, subjects performed a countermovement to a self-selected depth followed immediately
108 by triple extending at the ankles, knees, and hips performing a maximal effort vertical jump. Instructions
109 were to “jump as fast and as high as possible after my countdown”. Subjects were required to keep their
110 hands on hips and legs fully extended at all times during the flight phase of the jump; any deviation
111 from these resulted in a void trial and subsequently retaken after a 30-second rest period. The non-
112 jumping limb was required to remain slightly flexed at the hip and knee so that the foot was hovering
113 approximately parallel to the mid-shin of the jumping limb, with no swinging allowed. This was
114 monitored closely by an accredited strength and conditioning coach to ensure consistency throughout
115 all testing protocols. Prior to the assessment protocol, participants completed a standardized warm up
116 consisting of lower body dynamic stretches (multi-planar lunges, inchworms, ‘world’s greatest stretch’
117 and squat variations) and practice jumps at 60, 80, and 100% of maximum perceived effort. For data
118 collection, all subjects performed three trials on each limb at each time point, separated by a 30-second
119 rest period between each trial.

120 Force-time data were analyzed to obtain the dependant variables and manually extracted before being
121 transferred to a personal computer at 600 Hz though USB, which was initially examined through custom
122 made software (Ballistic measurement system, XPV7; Fitness Technology, Australia). The dependant
123 variables for the propulsive phase were: eccentric impulse (the sum of impulse from the end of
124 unweighting period up until the end of the braking phase), concentric impulse (the sum of impulse from
125 the end of the braking phase up until take off), peak force (maximum force obtained during the
126 propulsive phase of the jump), and jump height (jump height was calculated using the velocity at take-
127 off). For the landing phase: landing impulse (the sum of impulse upon landing up until peak landing
128 force) and peak landing force (maximum force obtained during the landing phase of the jump) were all
129 later calculated in Microsoft Excel with force thresholds calculated from body weight \pm 5 standard
130 deviations (SD) (11,17,36).

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Statistical Analysis

All statistical analysis was completed using SPSS Statistics software (version 21.0; SPSS, Inc., Armonk, NY, USA) with data presented as mean \pm SD. The normality of data was identified using the Shapiro-Wilk test. Previous research has highlighted reduced consistency and reliability when interpreting athlete data in a fatigued state (12); thus, reliability was computed at each time point. Reliability was calculated for each metric using the coefficient of variation (CV), a two-way random intraclass correlation coefficient (ICC) with absolute agreement and 95% confidence intervals, and the standard error of the measurement (SEM). CV were calculated in Microsoft Excel using the formula $(SD/average)*100$ and the SEM computed via the formula $SD*\sqrt{(1-ICC)}$. ICC's ≥ 0.70 and CV $< 10\%$ were considered acceptable (4,12). A one-way repeated measures ANOVA was used to compare the dependant variables in relation to each time point with statistical significance accepted at $p < 0.05$ and post-hoc Bonferroni testing was used when differences were identified. Cohen's d effect sizes (ES) were calculated to determine magnitude of change and interpreted in line with previous suggestions: trivial = < 0.35 ; small = $0.35-0.80$; moderate = $0.80-1.5$; large = > 1.5 (40). Finally, inter-limb asymmetries were quantified using a standard percentage difference method: $100/(max\ value)*(min\ value)*-1+100$ in line with previous suggestions (8), and the change in asymmetries were reported at each time as a percentage change relative to the baseline value.

160 **RESULTS**

161 **Within-session Reliability**

162 Upon further analysis illustrated in Table 1, it was found that the majority of metrics demonstrated
163 acceptable reliability and consistency in values. However, jump height and peak landing GRF were
164 found to show notably lower reliability ($ICC \leq 0.69$), in addition to landing impulse and concentric
165 impulse which demonstrated remarkably high variability (CV range = 18 to 30%) across a variety of
166 different time points.

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168 *** INSERT TABLE 1 ABOUT HERE ***

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170 **Change in Mean Scores**

171 A representation of all mean data and their subsequent changes in performance for each time point are
172 shown in Table 2. Group means were found to significantly ($p < 0.05$) decrease from baseline at all time
173 points for eccentric impulse, peak propulsive GRF and landing impulse, and significantly increase for
174 peak landing GRF. Significant decreases were also found from post and 24-h to 48-h and 72-h for
175 eccentric impulse and peak propulsive GRF. Further significant decreases were noted between 48-h to
176 72-h on the left side only for eccentric impulse and propulsive peak GRF. Finally, jump height was only
177 found to be significantly reduced on the left side between post to 24-h and increased between 24-h to
178 72-h.

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180 *** INSERT TABLE 2 ABOUT HERE ***

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182 **Change in Inter-limb Asymmetries**

183 Inter-limb asymmetry values for each time point are shown in Table 3 and Figure 1. SLCMJ mean
184 asymmetries significantly increased ($p < 0.05$) from pre to post and/or 24-h for concentric and eccentric
185 impulse, peak propulsive GRF, and peak landing GRF with small to large ES (0.37-3.15). Significant

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186 reductions in asymmetry were shown from post and 24-h to 48-h and 72-h for eccentric impulse, peak
187 propulsive GRF and peak landing GRF.

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189 *** INSERT TABLE 3 AND FIGURE 1 ABOUT HERE ***

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205 **DISCUSSION**

206 The aim of the present study was to quantify inter-limb asymmetries and jump performance in elite
207 academy soccer players before and after a match at incremental time points. Significant changes in side-
208 to-side differences and jump performance were observed at various time points with a trend for the
209 largest asymmetries and reduction in jump performance evident immediately post-match. As per the
210 hypothesis, inter-limb asymmetries returned to a similar level as the pre-match values at the 48-h time
211 point; however, jump performance for multiple metrics was still significantly reduced. These results
212 indicate that assessing multiple metrics during jump performance may be a more sensitive means of
213 identifying a player's readiness to recover in comparison to asymmetry alone.

214 Table 1 shows reliability data for CMJ metrics at all time points. The relevance here being that when
215 players have competed (and are in a fatigued state), this may impact the reliability of collected data;
216 thus, understanding its usability was required. Noting that CV values were considered acceptable if <
217 10%, the only metrics to consistently show acceptable CV were peak force (right), landing impulse
218 (right) and peak landing force (both). Typically, there was a trend for test variability to be lower at
219 baseline prior to the match; thus, the effects of a competitive soccer match may have had a detrimental
220 effect on the reliability of some metrics (e.g., eccentric impulse). However, it is important to highlight
221 that concentric impulse and jump height showed the largest variability (CV range = 18 to 30%); thus,
222 practitioners should be mindful of such metrics if monitoring unilateral jump performance during the
223 recovery period post-matches. Furthermore, when investigating 72-h in particular, it was clear to see
224 that due to the addition of a light tactical training session on the afternoon of 48-h, the reliability of
225 some metrics (such as jump height) were again detrimentally affected. Due to the constraints of
226 congested fixtures which is associated with professional soccer, it was not possible to allow these
227 players three days of recovery. Given the variation in metric reliability across time points, this further
228 supports the notion that in-depth jump analysis is key when interpreting real change (12,20,21).

229 Table 2 shows the mean scores for all jump metrics. Previously, it has been reported that impairment
230 of neuromuscular function is present up to 72-h post-match, with the 0 to 24-h showing the greatest

231 reduction in jumping and aerobic performance (12,20,29,42). Results from the present study showed
232 that only concentric impulse and jump height were fully recovered on both limbs at the 48-h time point,
233 with the remaining metrics still exhibiting significant differences from baseline two days post-match.
234 Notably, of all the metrics analysed, eccentric impulse and peak propulsive GRF yielded the greatest
235 significant change in means over the course of 24-h post-match (d range: post = 5.78-3.40, 24-h = 4.56-
236 2.99). A reduction in eccentric impulse capacity at all time points compared to baseline, likely resulted
237 in athletes altering their jump strategy, allowing time to produce the necessary force without
238 significantly affecting jump height in a fatigued state; thus, warranting the investigation of further
239 metrics other than jump height alone (13,20,21). Furthermore, jump height was shown to have no
240 significant decreases in performance post-match; rather, a small, non-significant increase was actually
241 seen on the left side at this time point. These results perhaps suggest that jump height maybe not be
242 sensitive enough to detect significant immediate change as athletes may mask fatigue by compensating
243 using different strategies (as discussed previously). When considering the landing metrics, landing
244 impulse and peak landing GRF were both sensitive enough to show large significant increases in force-
245 time data at each time point compared to baseline, which has also been shown in comparable research
246 (35). Although challenging to explain with certainty, it seems plausible to suggest that a loss of
247 neuromuscular control may explain why significant increases in landing forces were experienced. The
248 effects of a competitive match clearly resulted in ‘heavier landings’ which represent a serious
249 consideration for practitioners. Given that previous research has identified landing mechanics as being
250 a potential risk factor for injury (15,19,24), practitioners could consider landing-based metrics as useful
251 markers of readiness to train during the recovery process.

252 Table 3 and Figure 1 show the changing nature of inter-limb asymmetries at each time point. Initially,
253 ECC impulse and peak propulsive GRF showed the highest pre-match leg asymmetries (14.24 and
254 14.71, respectively). These were shown to significantly elevate immediately post-match increasing 2.25
255 and 2.16 times greater than baseline with large ES ($d = 3.15$ and 2.80 , respectively), then plateauing
256 over the succeeding 24-h before returning to near baseline 48-h. Notably, jump height was found to
257 display the greatest change in asymmetry, increasing immediately post-match by 3.7 times greater than

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258 pre-match, representing a moderate ES ($d = 1.18$). This is particularly striking as this metric showed
259 just a 4.65% asymmetry value pre-match, which can be considered small (7). The relevance being that
260 this has the potential to mislead practitioners unless monitored throughout the time course of 24 to 48-
261 h. Furthermore, given that jump height also showed high variability (CV range = 18 to 30%), this further
262 highlights the need to monitor multiple metrics during jump profiling, and not rely solely on outcome
263 measures. Interestingly, landing metrics were found to take longer to exhibit their peak leg asymmetries;
264 exponentially worsening until 24-h where both metrics climbed to 2.24 and 2.11 times greater than
265 baseline displaying large to moderate ES for landing impulse ($d = 1.7$) and peak landing GRF ($d =$
266 1.38), respectfully.

267 When interpreting asymmetries in a more general manner, previous research has highlighted the test
268 and metric-specific nature of asymmetries (9,14,23,26,28,39), and to the authors' knowledge, this is the
269 first study to examine the effects of competition on inter-limb asymmetries in an elite soccer population.
270 Previous research has suggested that 15% might be a threshold where the risk of injury increases (26);
271 however, more recent suggestions advocate 10% as a target to aim for (28,34). When this conflicting
272 evidence is considered and the test-specific nature of asymmetries is deliberated, it seems prudent to
273 suggest that multiple metrics be considered to further our understanding of how inter-limb asymmetries
274 interact with measures of physical performance and injury risk. In the present study, the largest inter-
275 limb differences were noted for peak propulsive force and eccentric impulse (Figure 1). Noting that
276 these metrics can only be obtained from a force platform and showed a trend to exhibit substantially
277 greater differences than the outcome measure of jump height, it is suggested (where possible) that the
278 monitoring of inter-limb differences is conducted using force platforms. As a final point, it is worth
279 noting that it is unlikely that elite soccer players will be granted three days of recovery after matches.
280 With a light tactical training session prescribed after the 48-h time point, this may explain the
281 subsequent increase in asymmetries at 72-h. The results highlight the importance of frequent asymmetry
282 monitoring, which has been emphasized in previous literature (7,35).

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285 **PRACTICAL APPLICATIONS**

286 The findings of the present study highlight the changing nature of jump performance and inter-limb
287 asymmetries after a competitive soccer match. Strength and conditioning coaches should consider using
288 the unilateral CMJ in addition to or in place of the more commonly accepted neuromuscular fatigue
289 monitoring method of bilateral CMJ. Noting that many of the actions in soccer occur unilaterally (such
290 as sprinting, changing direction, and kicking), it seems logical to suggest that unilateral jump profiling
291 serves as an ecologically valid means for soccer athletes. In addition, given the previously reported
292 associations between inter-limb asymmetries and reduced physical performance and injury risk,
293 frequent monitoring of side-to-side differences may provide practitioners with a true picture of the
294 interaction between asymmetry and performance or injury risk. The relevance here being that literature
295 pertaining to the longitudinal tracking of asymmetry is scarce. Finally, with leg asymmetries highlighted
296 up to 72-h, this insight can further objectively enlighten the coaching staff on player welfare and
297 subsequently inform their approach to adapting training loads on an individual level; thus, improving
298 training quality, player readiness and ultimately, match performance.

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415 Reduction in physical match performance at the start of the second half in elite soccer. *Int J*
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417 Table 1: Within-session reliability data for unilateral countermovement jump metrics at pre, post, 24, 48 and 72 hours post-match.

CMJ Metric	Pre	Post	24-h	48-h	72-h
Eccentric impulse (R)					
CV (%)	6.61	9.21	11.78	12.12	8.50
ICC (95% CI)	0.95 (0.82-0.99)	0.96 (0.87-0.99)	0.98 (0.97-0.99)	0.95 (0.34-0.99)	0.90 (0.45-0.97)
SEM	2.74	2.43	2.25	4.06	3.87
Eccentric impulse (L)					
CV (%)	8.76	10.59	13.12	11.94	11.39
ICC (95% CI)	0.93 (0.77-0.98)	0.89 (0.65-0.96)	0.97 (0.89-0.99)	0.84 (0.69-0.96)	0.97 (0.80-0.99)
SEM	3.51	3.22	2.24	6.18	2.32
Concentric impulse (R)					
CV (%)	18.25	17.99	20.95	21.04	21.18
ICC (95% CI)	0.77 (0.42-0.92)	0.76 (0.42-0.92)	0.89 (0.69-0.97)	0.74 (0.38-0.91)	0.71 (0.32-0.89)
SEM	13.92	10.94	9.34	15.20	15.21
Concentric impulse (L)					
CV (%)	20.29	20.73	22.48	23.97	20.73
ICC (95% CI)	0.85 (0.55-0.95)	0.77 (0.29-0.92)	0.75 (0.27-0.92)	0.84 (0.52-0.95)	0.77 (0.27-0.92)
SEM	11.43	11.29	12.47	12.41	11.22
Peak force (R)					
CV (%)	5.52	8.15	9.67	8.35	7.91
ICC (95% CI)	0.80 (0.58-0.95)	0.92 (0.77-0.97)	0.95 (0.87-0.99)	0.56 (0.11-0.83)	0.85 (0.60-0.95)
SEM	41.05	29.48	26.57	78.83	40.04
Peak force (L)					
CV (%)	10.38	10.68	14.33	12.28	11.55
ICC (95% CI)	0.89 (0.86-0.99)	0.95 (0.84-0.98)	0.92 (0.78-0.99)	0.90 (0.78-0.99)	0.99 (0.96-0.99)
SEM	33.69	21.43	35.70	46.13	12.75
Jump height (R)					
CV (%)	19.51	29.29	19.68	22.19	23.48
ICC (95% CI)	0.89 (0.71-0.96)	0.69 (0.27-0.89)	0.92 (0.78-0.97)	0.89 (0.71-0.96)	0.77 (0.43-0.92)
SEM	0.01	0.03	0.01	0.01	0.02

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Jump height (L)					
CV (%)	22.15	30.00	25.80	24.23	30.00
ICC (95% CI)	0.85 (0.25-0.96)	0.60 (0.20-0.86)	0.86 (0.60-0.95)	0.72 (0.31-0.90)	0.57 (0.17-0.85)
SEM	0.02	0.04	0.02	0.02	0.04
Landing impulse (R)					
CV (%)	8.96	8.13	7.64	7.05	8.71
ICC (95% CI)	0.68 (0.28-0.88)	0.63 (0.20-0.86)	0.57 (0.11-0.84)	0.58 (0.12-0.84)	0.65 (0.23-0.87)
SEM	1.41	1.69	1.72	1.42	1.72
Landing impulse (L)					
CV (%)	8.96	8.13	16.18	14.81	15.00
ICC (95% CI)	0.81 (0.52-0.93)	0.84 (0.59-0.95)	0.70 (0.32-0.89)	0.81 (0.53-0.93)	0.81 (0.54-0.93)
SEM	1.09	1.10	2.79	1.76	1.93
Peak landing force (R)					
CV (%)	7.48	7.63	7.93	8.86	7.80
ICC (95% CI)	0.90 (0.73-0.97)	0.93 (0.78-0.98)	0.89 (0.70-0.96)	0.88 (0.67-0.96)	0.91 (0.75-0.97)
SEM	62.36	64.96	86.78	91.96	74.32
Peak landing force (L)					
CV (%)	7.48	7.63	8.63	5.72	5.86
ICC (95% CI)	0.74 (0.25-0.94)	0.71 (0.32-0.89)	0.83 (0.26-0.98)	0.64 (0.21-0.87)	0.69 (0.27-0.90)
SEM	101.77	134.15	134.76	109.92	119.97

CMJ = countermovement jump; R = Right; L = Left; CV = coefficient of variation; ICC = intraclass correlation coefficient; CI = confidence interval; SEM = standard error of the measurement.

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423 Table 2: Mean unilateral countermovement jump data \pm standard deviations for pre, post, 24, 48 and 72 hours post-match.

CMJ Metric	Pre	Post	24-h	48-h	72-h
ECC impulse-R (Ns)	173.68 \pm 11.67 ^{bcde}	135.54 \pm 12.48 ^{ac}	134.96 \pm 15.90 ^{abd}	152.88 \pm 18.52 ^{abc}	141.24 \pm 12.00 ^a
ECC impulse-L (Ns)	135.54 \pm 13.28 ^{bce}	92.17 \pm 9.76 ^{ade}	95.56 \pm 12.53 ^{ade}	130.97 \pm 15.64 ^{bce}	110.52 \pm 12.59 ^{abcd}
CON impulse-R (Ns)	157.64 \pm 28.77 ^b	124.96 \pm 22.47 ^a	135.11 \pm 28.30	141.17 \pm 29.70	132.19 \pm 28.00 ^a
CON impulse-L (Ns)	147.49 \pm 29.92 ^{bce}	112.35 \pm 23.29 ^a	110.51 \pm 24.84 ^a	129.87 \pm 31.13	112.35 \pm 23.29 ^a
Peak force-R (N)	1679.1 \pm 92.73 ^{bcde}	1278.52 \pm 104.23 ^{ade}	1280.76 \pm 123.89 ^{ade}	1428.09 \pm 119.25 ^{abc}	1325.51 \pm 104.79 ^{abc}
Peak force-L (N)	1432.16 \pm 100.66 ^{bcde}	871.36 \pm 93.08 ^{ade}	903.53 \pm 129.51 ^{ade}	1206.53 \pm 148.10 ^{abce}	1052.69 \pm 121.58 ^{abcd}
Jump height-R (m)	0.19 \pm 0.04	0.19 \pm 0.06	0.16 \pm 0.03	0.16 \pm 0.04	0.17 \pm 0.04
Jump height-L (m)	0.19 \pm 0.07	0.20 \pm 0.06 ^c	0.16 \pm 0.04 ^{be}	0.17 \pm 0.04	0.20 \pm 0.06 ^c
Landing impulse-R (Ns)	29.38 \pm 2.22 ^{bc}	31.18 \pm 2.15 ^{ae}	31.68 \pm 5.13 ^{ae}	30.27 \pm 4.04 ^c	29.57 \pm 4.44 ^{bc}
Landing impulse-L (Ns)	27.83 \pm 2.49 ^{bce}	34.08 \pm 2.77 ^a	36.20 \pm 2.61 ^{abd}	31.14 ^{abc}	31.33 \pm 2.90 ^a
Peak landing force-R (N)	2662.81 \pm 199.21 ^{bcde}	2963.55 \pm 212.91 ^{ace}	3271.16 \pm 259.30 ^{abd}	2983.55 \pm 264.37 ^{ace}	3195.73 \pm 249.12 ^{abd}
Peak landing force-L (N)	2811.71 \pm 179.22 ^{bcde}	3263.55 \pm 249.10 ^{ace}	3823.25 \pm 329.77 ^{abd}	3217.99 \pm 184.23 ^{ace}	3703.72 \pm 216.87 ^{abd}

CMJ = countermovement jump; ECC = eccentric; CON = concentric; R = Right; L = Left; ^a = significantly different from pre-match value; ^b = significantly different from post-match value; ^c = significantly different from 24-h match value; ^d = significantly different from 48-h match value; ^e = significantly different from 72-h match value.

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429 Table 3: Inter-limb asymmetry values (reported as percentages) for unilateral countermovement jump data pre, post, 24, 48 and 72 hours post-match and Cohen's
 430 *d* effect sizes reported relative to pre-match values.

Asymmetry %	Pre	Post	24-h	48-h	72-h
ECC impulse	14.24 ^{bce}	32.00 ^{ade}	29.20 ^{ade}	14.33 ^{bc}	21.75 ^{abc}
Effect size		3.15	2.80	0.01	1.36
CON impulse	7.73 ^c	10.50	18.50 ^a	9.88	15.19
Effect size		0.31	1.02	0.30	0.84
Peak force	14.71 ^{bc}	31.85 ^{ade}	29.45 ^{ade}	15.51 ^{bc}	20.58 ^{bc}
Effect size		2.80	2.23	0.12	0.96
Jump height	4.65 ^e	17.22	6.52 ^e	5.47	20.49 ^{ac}
Effect size		1.18	0.50	0.23	2.05
Peak landing impulse	5.89 ^c	8.51 ^{cde}	13.14 ^{abde}	4.03 ^{bc}	5.61 ^{bc}
Effect size		0.62	1.71	-0.47	-0.07
Peak landing force	7.22 ^{ce}	9.13 ^{ce}	15.22 ^{abd}	7.29 ^{ce}	13.72 ^{abd}
Effect size		0.32	1.38	0.01	1.19

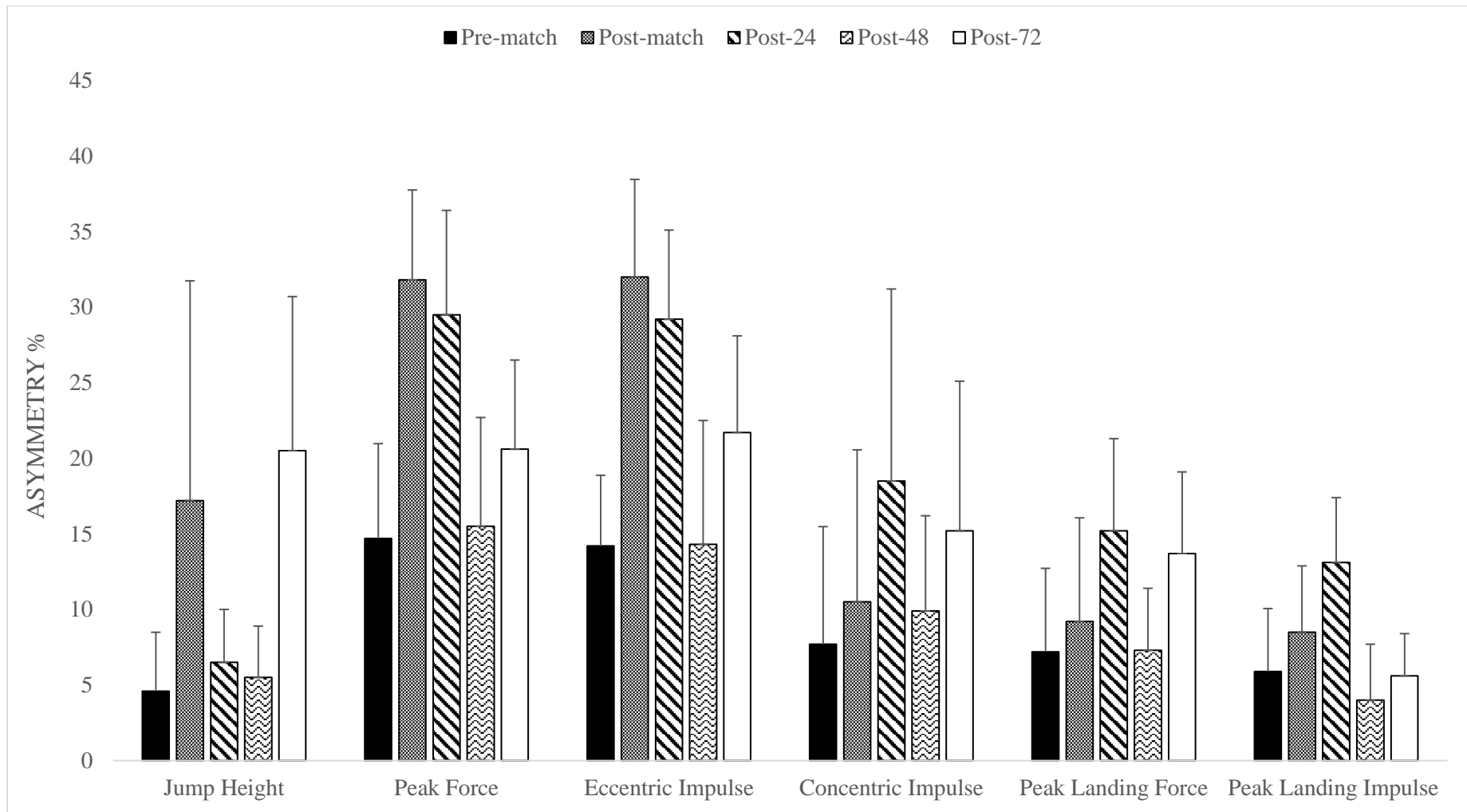
ECC = eccentric; CON = concentric; ^a = significantly different from pre-match value; ^b = significantly different from post-match value; ^c = significantly different from 24-h match value; ^d = significantly different from 48-h match value; ^e = significantly different from 72-h match value.

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435 Figure 1: Inter-limb asymmetry values and standard deviations (error bars) for SLCMJ metrics at pre, post, 24, 48 and 72 hours post-match.