As an outfielder, jumping is perhaps likely to occur when reaching for a catch and are likely to be more role-specific. Fast bowlers are likely to employ ballistic jumps prior to ball release during the bowling action (28). Given this repeatable action during bowling, the development of asymmetries could be somewhat expected. When batting, jumping is less common; however, increased loading on one limb is likely given the requirement to move the front limb in to various positions dependent on the shot attempted (39). Thus, the development of asymmetries should also be expected as a consequence of batting and has been reported elsewhere (19). In addition, high intensity sprints are less common (compared to soccer) and have been reported to occur for an average of 1.2 seconds with a work-to-rest ratio of 1:50 (34); thus, representing substantial recovery times (37). Thus, the increased jump performance and faster 10 m times for soccer athletes in the present study is arguably expected.

In contrast, cricket athletes showed significantly faster GCT's during the SLDJ on the left limb (ES = 0.80). That said, there are two possible means of improving an athlete's RSI: jump higher and/or spend less time on the ground. It would appear that soccer athletes' greater jumping ability outweighed cricket athletes' faster GCT's because they also showed significantly greater RSI scores on the right side (ES = 0.80). A definitive explanation for the different jump strategies seen in the present study between sports is challenging. However, given that soccer athletes are likely more familiar with jumping actions compared to cricketers, it seems logical to assume that this may serve as one of the key reasons why significant differences in jump height were seen in a more technically advanced jump, such as the SLDJ.

Figures 1-4 show individual inter-limb asymmetry scores for the SLCMJ and SLDJ tests. The SLCMJ showed no significant differences in asymmetry scores between groups. SLCMJ jump height showed the greatest between-limb asymmetries in both sports (9.57-11.14%) and is comparable to previously reported jump height asymmetries during the same test (4,24). Conversely, for the SLDJ, cricket athletes were significantly more asymmetrical than the soccer players for jump height (p = 0.015) and RSI (p = 0.014). This is in part supported by Maloney et al. (26), who showed that jump height asymmetries (also from a SLDJ) were able to distinguish between faster and slower athletes during a CODS test. Given the increased technicality associated with drop jumping compared to the SLCMJ (33), it is possible that this test highlighted larger asymmetries in cricket athletes due to a lack of training at fast stretch-shortening-based plyometric activities.

Table 2 shows the correlations between inter-limb asymmetry scores and speed and CODS times. No significant correlations were found in the soccer group in either test; however, significant positive correlations were found between jump height and RSI asymmetries during the SLDJ and 505 times on both limbs in the cricket group. Firstly, it is important to note that these relationships are positive, which indicates that if an asymmetry is larger, the time to perform the 505 test was higher, which is not the desired outcome for any speed or CODS test. Thus, larger drop jump asymmetries are indicative of slower CODS time in professional cricket athletes. The technical nature of the SLDJ test may in part explain these findings. Drop jumps require a very specific transition from braking forces to propulsive forces; this represented by an athlete's ability to spend a short time on the ground and jump as high as possible (26,33). Thus, it seems logical to assume that if substantial asymmetries are present (i.e., > 10%) (5,23), these may impact performance on a task also governed by effective braking and re-acceleration capacity (31), such as the 505 test. Furthermore, the only significant correlations between asymmetry and performance were in the metrics where cricket athletes showed significantly greater asymmetries than soccer athletes. Thus, the magnitude of asymmetry during the SLDJ would appear to be relevant between groups during the 505 test.

Despite the usefulness of these findings, a few limitations should be acknowledged. Firstly, given the variable and individual nature of asymmetries, these findings are only applicable to the tested soccer and cricket athletes. Further research should aim to establish the effects asymmetry has on physical performance comparing across more sporting populations where possible. Furthermore, the methods employed in the present study did not apply a randomized test order. Given the possible effects this may have on fatigue during testing, practitioners are encouraged to adhere to randomized testing. Secondly, inter-limb asymmetries were presented as left vs. right in the present study, rather than defining limbs via dominance. The rationale for this was because different definitions would have been required to define limb dominance, noting that this is a comparison between two different sports. However, practitioners should be mindful that there is no guarantee that the same limb (left or right) will always be the dominant one during athlete populations (13), especially in a sport such as soccer which has distinct positional differences. Thus, defining limbs via dominance may provide practitioners with notable differences in results and are encouraged to perform their own analysis in line with what is deemed most appropriate for their population.

In summary, inter-limb asymmetries measured during the SLDJ test were able to differentiate between professional cricket and soccer athletes. Cricket athletes exhibited significantly greater jump height and RSI asymmetries and these imbalances were also associated with impaired CODS performance during the 505 test on both limbs. Future research should aim to establish if training strategies which target the reduction of inter-limb asymmetries are indicative of improved physical performance.

PRACTICAL APPLICATIONS

In the present study, larger DJ asymmetries were associated with reduced CODS performance in professional cricket athletes and this was not observed in soccer athletes. Therefore, it seems prudent to suggest that reducing these between-limb differences is warranted within this representative cohort of professional cricketers. Literature has highlighted that unilateral training may be favourable over bilateral methods when aiming to minimize asymmetries (14). In this context, given that associations with reduced CODS performance were evident, it is logical to suggest training methods that align with the test goal. Exercises such as unilateral CMJ's, hopping and repeated hurdle hops will encourage a good combination of training for maximal height and true plyometric development. It is also suggested that unilateral strength training not be ignored. Exercises such as split squats, step ups and lunges offer a viable means of targeting each limb independently and should likely be integrated regularly into athlete programs. Therefore, it is reasonable to suggest that such unilateral training methods may address capacity deficits in the weaker limb, which may indirectly improve CODS performance and potentially reduce the risk of injury.

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Table 1: Mean test ± standard deviations (SD), test reliability and effect size data for each sport.

Fitness Test	**Soccer Athletes (*n* = 18)**			**Cricket Athletes (*n* = 23)**			**Effect size between sports (95% CI)**
	Mean ± SD	*CV (%)*	*ICC (95% CI)*	*Mean ± SD*	*CV (%)*	*ICC (95% CI)*	
SLCMJ:							
Jump height-L (m)	0.18 ± 0.04	8.18	0.95 (0.89-0.98)	0.19 ± 0.03	7.65	0.92 (0.83-0.96)	0.28 (-0.34 to 0.90)
Jump height-R (m)	0.18 ± 0.04	8.38	0.93 (0.85-0.97)	0.18 ± 0.03	7.85	0.94 (0.87-0.97)	0.00 (-0.62 to 0.62)
Peak force-L (N)	773.89 ± 125.47	7.05	0.92 (0.81-0.97)	761.87 ± 139.85	9.80	0.88 (0.76-0.94)	-0.09 (-0.71 to 0.53)
Peak force-R (N)	773.44 ± 139.52	8.07	0.90 (0.79-0.96)	726.57 ± 167.48	8.87	0.95 (0.89-0.98)	-0.30 (-0.92 to 0.32)
CON impulse-L (N·s)	131.33 ± 30.30	7.62	0.95 (0.87-0.98)	144.43 ± 25.31	4.49	0.98 (0.95-0.99)	0.47 (-0.16 to 1.09)
CON impulse-R (N·s)	135.50 ± 28.44	7.13	0.96 (0.91-0.98)	143.00 ± 25.69	6.23	0.95 (0.91-0.98)	0.28 (-0.34 to 0.90)
SLDJ:							
Jump height-L (m)	22.39 ± 4.02**	4.94	0.97 (0.94-0.99)	18.47 ± 4.45	9.69	0.94 (0.89-0.97)	-0.92 (-1.57 to -0.28)
Jump height-R (m)	22.82 ± 3.83**	5.55	0.93 (0.85-0.97)	18.48 ± 4.06	8.45	0.94 (0.88-0.97)	-1.10 (-1.76 to -0.44)
GCT-L (ms)	0.29 ± 0.03**	6.34	0.88 (0.75-0.95)	0.27 ± 0.02	5.46	0.73 (0.46-0.88)	-0.78 (-1.42 to -0.14)
GCT-R (ms)	0.29 ± 0.04	4.55	0.92 (0.83-0.97)	0.28 ± 0.02	4.09	0.88 (0.76-0.94)	-0.32 (-0.94 to 0.30)
RSI-L	1.46 ± 0.20	6.24	0.94 (0.87-0.98)	1.37 ± 0.18	5.11	0.94 (0.88-0.97)	-0.47 (-1.10 to 0.15)
RSI-R	1.48 ± 0.21*	5.01	0.94 (0.86-0.98)	1.32 ± 0.19	4.72	0.94 (0.89-0.97)	-0.80 (-1.44 to -0.16)
10 m (s)	1.69 ± 0.08**	3.83	0.72 (0.34-0.89)	1.76 ± 0.07	2.25	0.77 (0.55-0.90)	0.93 (0.28 to 1.58)
505-L (s)	2.27 ± 0.07	1.57	0.87 (0.65-0.95)	2.21 ± 0.10	2.25	0.86 (0.71-0.94)	-0.70 (-1.33 to -0.06)
505-R (s)	2.26 ± 0.06	1.24	0.85 (0.59-0.95)	2.22 ± 0.12	2.09	0.93 (0.82-0.97)	-0.42 (-1.05 to 0.20)

** indicates significantly different from cricket ($p < 0.01$); * indicates significantly different from cricket ($p < 0.05$)

CV = coefficient of variation; ICC = intraclass correlation coefficient; CI = confidence intervals; SLCMJ = single leg countermovement jump; CON = concentric; m = metres; N = Newtons; N·s = Newton seconds; SLDJ = single leg drop jump; GCT = ground contact time; RSI = reactive strength index; ms = milliseconds; s = seconds.

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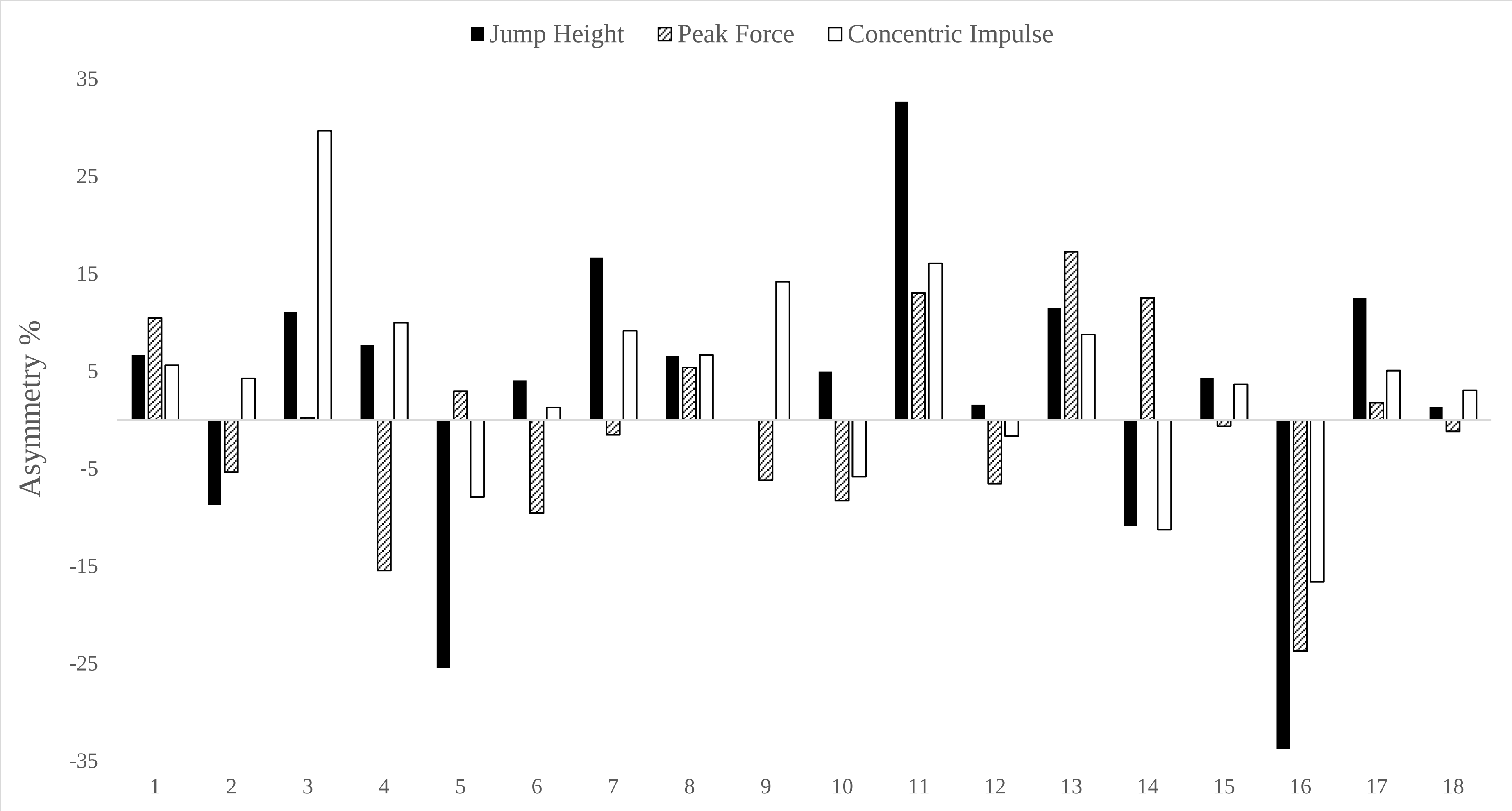

Figure 1: Individual asymmetry data for professional soccer athletes (*n* = 18) during the single leg countermovement jump. Note: above the 0 line indicates asymmetry favours the right leg and below the 0 line asymmetry favours the left leg.

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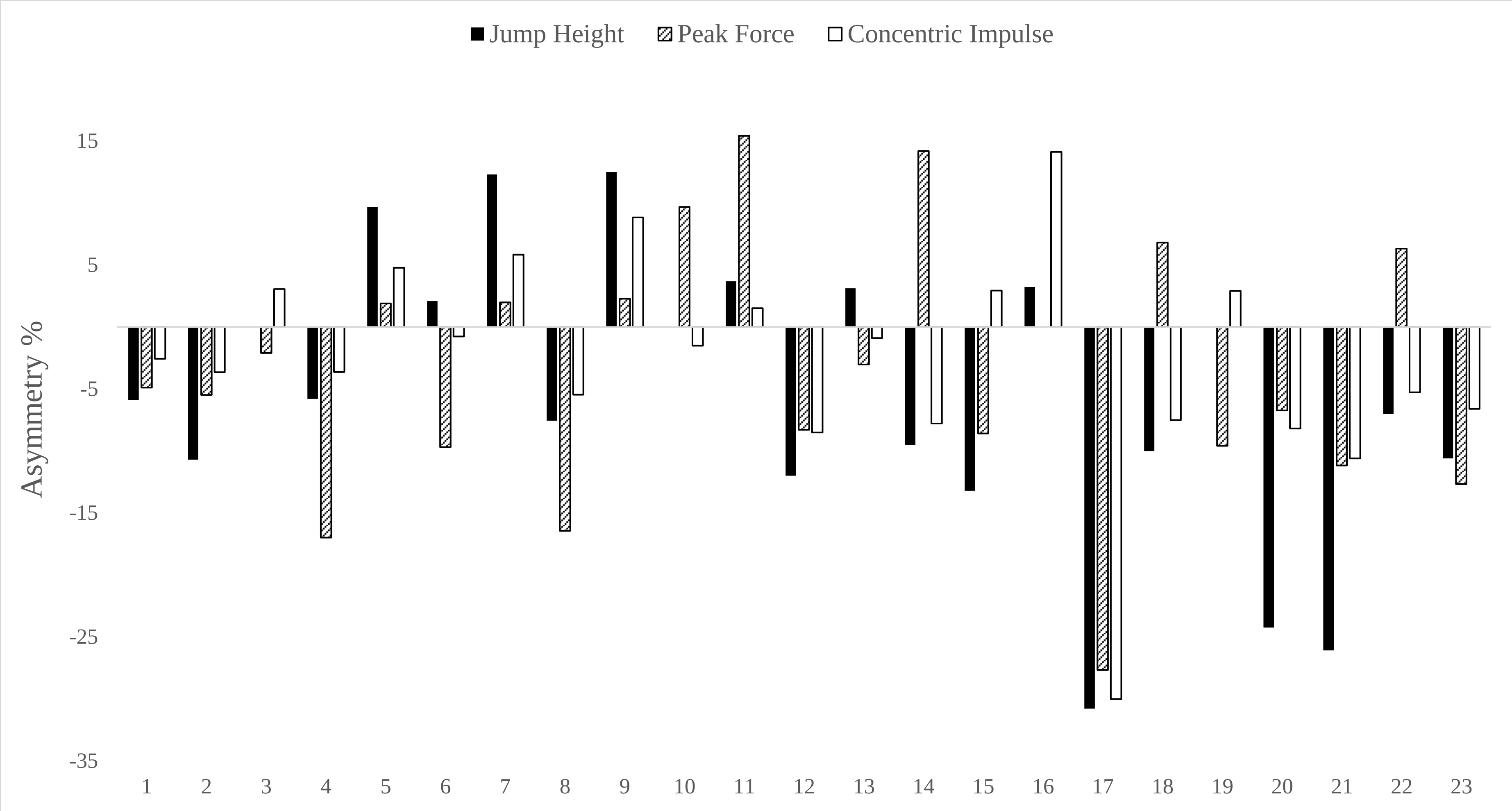

Figure 2: Individual asymmetry data for professional cricket athletes (*n* = 23) during the single leg countermovement jump. Note: above the 0 line indicates asymmetry favours the right leg and below the 0 line asymmetry favours the left leg.

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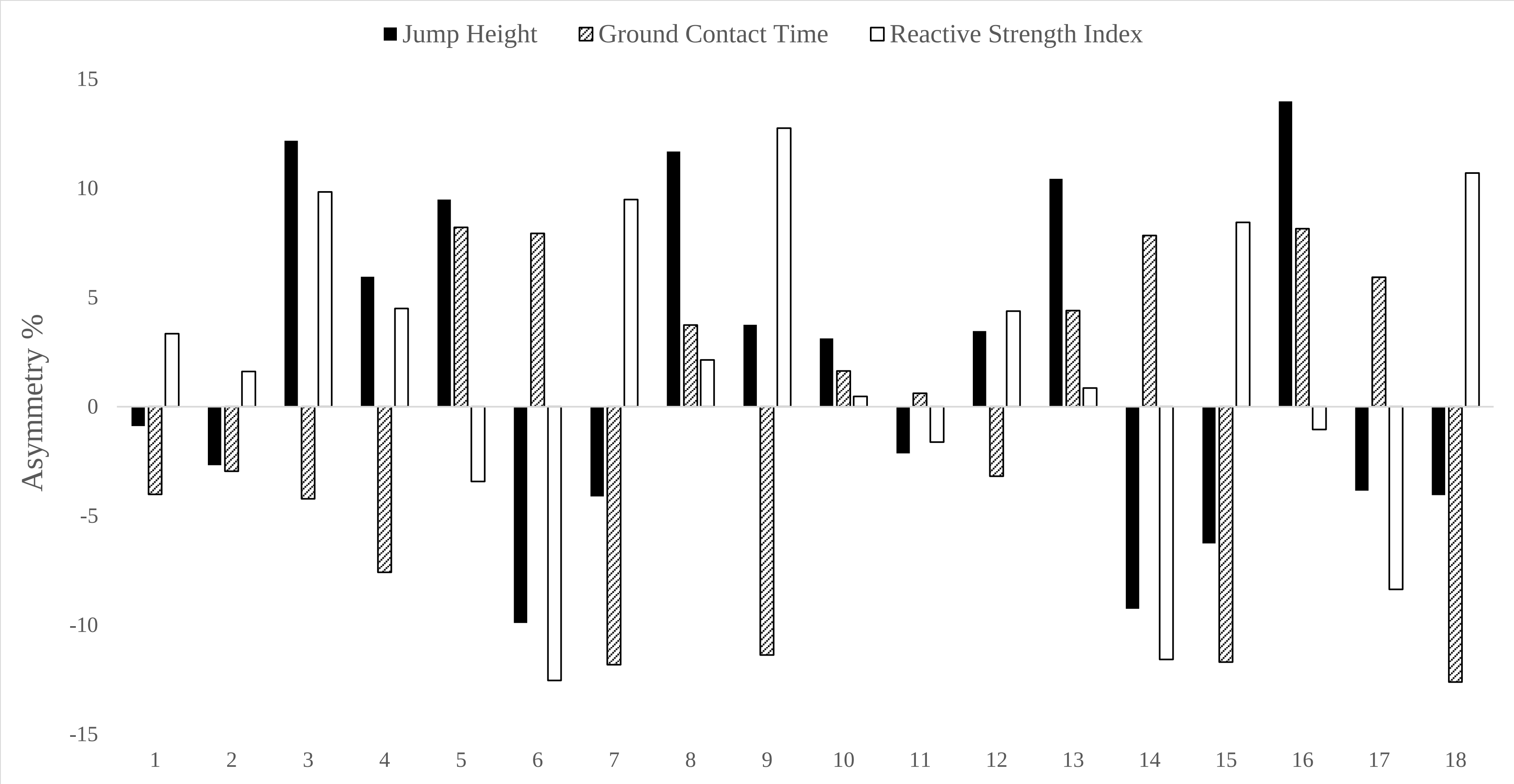

Figure 3: Individual asymmetry data for professional soccer athletes (*n* = 18) during the single leg drop jump. Note: above the 0 line indicates asymmetry favours the right leg and below the 0 line asymmetry favours the left leg.

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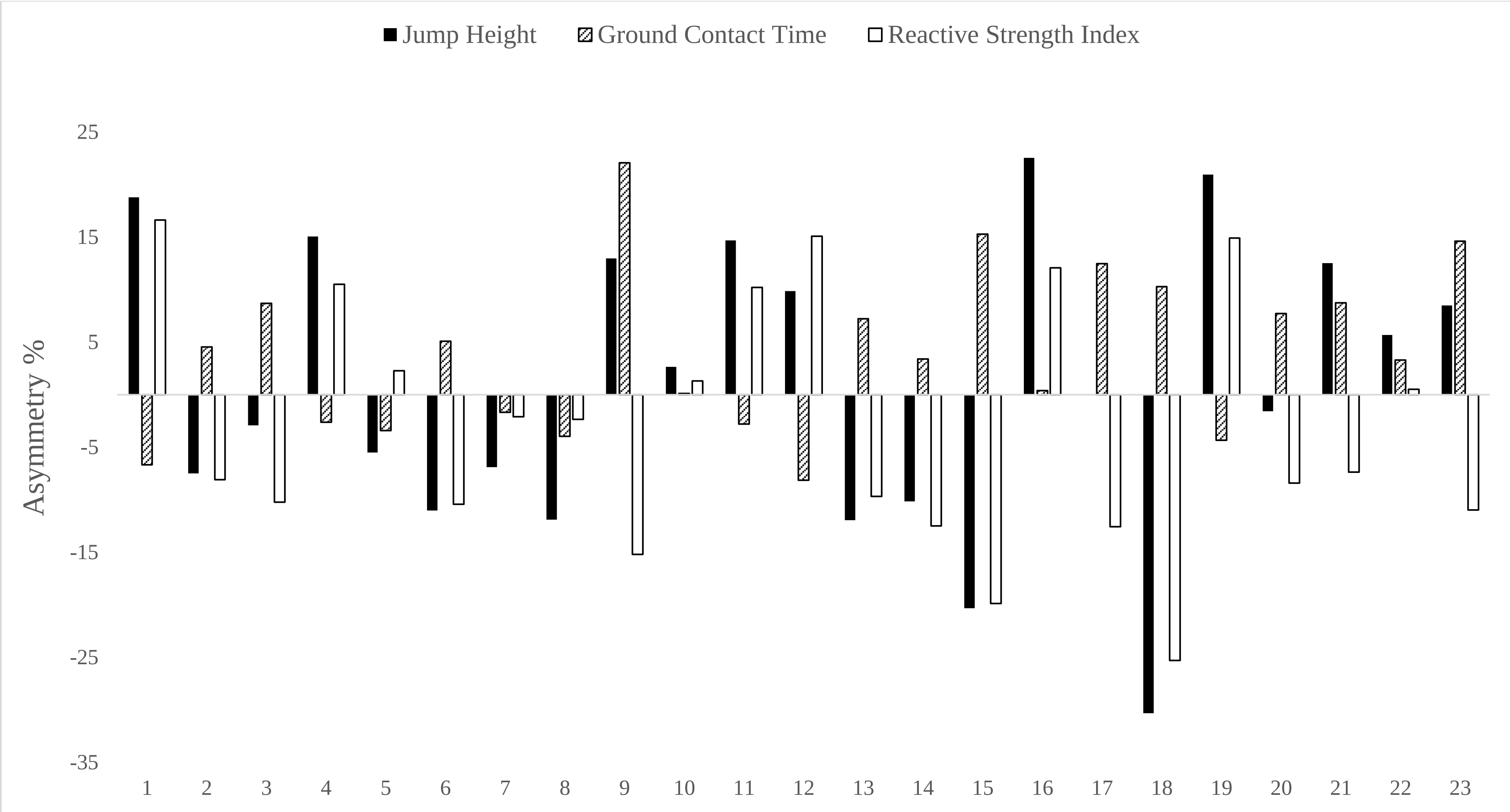

Figure 4: Individual asymmetry data for professional cricket athletes (*n* = 23) during the single leg drop jump. Note: above the 0 line indicates asymmetry favours the right leg and below the 0 line asymmetry favours the left leg.

Table 2: Spearman's *r* correlations (95% confidence intervals) between inter-limb asymmetry scores and speed and change of direction speed tests.

Asymmetry Test/Metric (%)	**Soccer Athletes (*n* = 18)**			**Cricket Athletes (*n* = 23)**		
	10 m	*505 (left)*	*505 (right)*	*10 m*	*505 (left)*	*505 (right)*
SLCMJ:						
Jump height	0.11 (-0.38 to 0.55)	-0.23 (-0.63 to 0.27)	0.14 (-0.35 to 0.57)	-0.07 (-0.52 to 0.41)	0.03 (-0.44 to 0.49)	0.07 (-0.41 to 0.52)
Peak force	-0.30 (-0.67 to 0.19)	-0.07 (-0.52 to 0.41)	-0.03 (-0.49 to 0.44)	-0.07 (-0.52 to 0.41)	0.22 (-0.28 to 0.62)	0.15 (-0.34 to 0.58)
CON impulse	0.33 (-0.16 to 0.69)	-0.23 (-0.63 to 0.27)	0.29 (-0.21 to 0.67)	0.36 (-0.13 to 0.71)	0.37 (-0.12 to 0.71)	0.27 (-0.23 to 0.65)
SLDJ:						
Jump height	0.18 (-0.31 to 0.60)	0.39 (-0.09 to 0.73)	0.29 (-0.21 to 0.67)	0.28 (-0.22 to 0.66)	0.56 (0.13 to 0.81)*	0.59 (0.17 to 0.83)*
GCT	0.20 (-0.29 to 0.61)	0.15 (-0.34 to 0.58)	-0.12 (-0.56 to 0.37)	0.02 (-0.45 to 0.48)	0.23 (-0.27 to 0.63)	0.10 (-0.39 to 0.54)
RSI	0.35 (-0.14 to 0.70)	0.23 (-0.27 to 0.63)	-0.12 (-0.56 to 0.37)	0.36 (-0.13 to 0.71)	0.74 (0.42 to 0.90)*	0.63 (0.23 to 0.85)*

* indicates statistical significance at $p < 0.01$

SLCMJ = single leg countermovement jump; CON = concentric; SLDJ = single leg drop jump; GCT = ground contact time; RSI = reactive strength index.