Body Composition and Morphological Asymmetries in University Level Soccer Players

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Introduction

Soccer is a worldwide popular sport played by both men and women (1). Like most sports, soccer players have a natural tendency to use one side of their body to complete tasks making it a lateral dominant sport (2). To date, several reports have debated on possible explanations for the development of lateral dominance and irregularities regarding the use of both limbs in soccer.

The study of asymmetry (e.g., side-to-side differences) in both kinetic and kinematics measures, as well as morphological asymmetry in athletes may play an important role in identifying players with greater risk injury. Players with muscle strength asymmetries were reported to have a 16.5% risk of lower limb injury as compared to 4.1% in players with no asymmetry (3,4,5). It was suggested that the spine counterbalances in order to compensate for such functional asymmetry of the lower limbs, which may eventually result in LBP (4).

Although it is well known that body composition affects sports performance (6), few studies have specifically examined how morphological asymmetry of the limbs and trunk may negatively influence player's technical skills and susceptibility to injury. More specifically, whilst it is optimal for soccer players to be lean and have lower fat tissue, (7) whether lateral dominance and repeated kicking movements eventually leads to morphological asymmetry of the lower limbs remains undetermined.

Objectives

1) Investigate the presence and extent of side-to-side asymmetries in body composition in male and female soccer players
2) Examine possible associations between the degree of asymmetry with LBP and lower leg injuries (LLI).

Methodology

Twenty-seven soccer players (12 females, 15 males) from the Concordia University varsity team were included. Body composition measurements were obtained during the preseason using dual-energy X-ray absorptiometry (DEXA). A self-administrated questionnaire was used to collect information about the player's history of sports, injuries and LBP. Parameter of interest included bone mass, lean body mass, and fat mass for both the right and left sides and were also analyzed by anatomical body segments: arms, legs, trunk and total body (Table 1).

The difference between the right and left sides for body composition parameters with normal distribution were assess using paired student t-tests, while Wilcoxon signed rank test was used for parameters with non-normal distributions

	Males (n = 15)			Females (n = 12)		
	Right	Left	p-value & 95%CI	Right	Left	p-value & 95%CI
Bone Mass (g)						
Arm	228.10 ± 36.83	214.87 ± 30.18	0.02 [2.56, 23.90] *	158.80 ± 25.64	153.25 ± 20.94	0.02 [0.98, 10.13] *
Leg	685.22 ± 107.82	687.56 ± 95.90	0.62 [-12.13, 7.46]	481.98 ± 69.78	395.74 ± 69.78	0.19 [-12.36, 2.69]
Trunk	503.48 ± 82.35	506.56 ± 83.10	0.71 [-20.46, 14.29]	395.74 ± 60.76	400.47 ± 65.32	0.22 [-12.71, 3.25]
Total	1721.01 ± 245.72	1658.23 ± 202.55	0.04 [3.45, 122.08] *	1273.18 ± 181.17	1294.23 ± 161.22	0.26 [-60.37, 18.28]
LBM (g)						
Arm	3611.97 ± 673.13	3421.02 ± 532.90	0.04 [10.06, 371.84] *	2305.08 ± 259.88	2252.18 ± 253.37	0.11 [-14.23, 120.04]
Leg	10437 ±1342.73	10404.61 ± 1104.41	0.82 [-280.76, 347.35]	7575.65 ± 931.29	7477.26 ± 894.35	0.35 [-122.30, 319.09]
Trunk	13740.67 ± 1561.86	13990.86 ± 1625.99	0.08 •	10385.01 ± 1040.08	10665.40 ± 996.66	0.07 [-585.96, 25.19]
Total	29678.98 ± 3316.42	29383.10 ± 3234.16	0.24 [-215.09, 806.86]	21675.83 ± 2138.11	21936.14 ± 2013.13	0.02 [-478.31, -42.31] *
Fat Mass (g)						
Arm	555.92 ± 141.19	521.35 ± 120.45	0.09 [-5.69, 74.84]	1065.76 ± 295.76	1028.50 ± 277.12	0.01 * •
Leg	1818.30 ± 564.08	1854.55 ± 526.66	0.13 [-84.79, 12.30]	3696.04 ± 1002.07	3640.08 ± 924.03	0.94 •
Trunk	2159.85 ± 597.5	2232.40 ± 691.23	0.36 •	4151.76 ± 1658.56	4213.42 ± 1695.51	0.41 [-281.38, 95.25]
Total	5028.56 ± 1108.52	5015.95 ± 1250.35	0.90 [-188.14, 213.35]	9292.22 ± 2869.13	9294.82 ± 2832.76	0.97 [-131.35, 126.15]

Table 1. Body composition measurements for male and female soccer players.
* = significant ($p<0.05$)

• = Values with no 95% CI were from Wilcoxon signed rank test

Results

Significant differences in bone mass were observed in male players, with the right arm ($p=0.02$) and right total bone mass ($p=0.04$) showing larger values.

Total lean body mass (LBM) was statistically greater on the right side in females ($p=0.02$), while LBM of the right arm was statistically greater in male players ($p=0.04$). No asymmetry in LBM for the leg or trunk body segments were observed in male or female players.

There was no right-left differences for fat mass, apart from females having larger arm fat mass values on the right side ($p=0.01$) as compared to the left side.

Males had greater right-left asymmetries in trunk bone mass ($p=0.03$), total bone mass ($p=0.03$) total fat mass ($p=0.04$), and total lean mass ($p=0.03$) (Table 2).

There were no statistically significant associations between the degree of right-left asymmetry and the history of LLI or LBP for any of the body composition parameter of interest.

	Female	Male	|Difference|	p-value & 95% CI
Bone Mass (g)				
Arm	7.23 ± 5.34	16.29 ± 16.58	9.06	0.06 [-18.64, 0.52]
Leg	10.48 ± 6.78	12.01 ± 3.30	1.54	0.69 [-9.50, 6.43]
Trunk	10.87 ± 2.11	23.81 ± 5.08	12.93	0.03 [-24.46, -1.41] *
Total	51.51 ± 37.67	99.37 ± 71.46	47.86	0.04 [-92.28, -3.43] *
LBM (g)				
Arm	100.62 ± 56.31	254.70 ± 276.15	154.08	0.05 [-309.57, 1.40]
Legs	257.90 ± 242.18	404.58 ± 383.90	146.68	0.24 [-397.10, 103.74]
Trunk	445.48 ± 317.13	618.91 ± 486.88	173.43	0.27 [-494.29, 147.43]
Total	342.75 ± 251.96	740.67 ± 597.83	397.91	0.03 [-754.23, -41.59] *
Fat Mass (g)				
Arm	39.81 ± 44.28	58.05 ± 54.38	18.24	0.35 [-57.35, 20.87]
Leg	145.98 ± 159.51	70.83 ± 60.96	75.15	0.15 [-29.52,179.83]
Trunk	200.67 ± 145.61	213.46 ± 142.73	12.79	0.82 [-127.65, 102.08]
Total	151.77 ± 126.27	288.71 ± 205.58	136.94	0.04 [-269.95, -3.93] *

Table 2. Comparison of asymmetry between genders
* = significant ($p<0.05$)

Discussion

Our findings suggest that there is no significant side-to-side asymmetry in lower-limb body composition in male and female college soccer players, and no association between the degree of asymmetry and their history of LBP or LLI.

Running may outweigh the effects of kicking in soccer players, a theory that is in accordance with our results (2). For elite soccer players, it is critical to master the skill of controlling the ball while running. Being two-footedness has its strategic advantages and would possibly reduce the chances of asymmetry (8).

Previous studies suggest that asymmetry in the lower limbs has less of a correlation with LBP and more with the strength of the athlete's core muscles. For LLI, its suggested that the presence of lower-limb asymmetry increases the chances of injury for soccer players (5).

Clinical Relevance

Assessing athletes body composition for asymmetries may be a valuable tool for the development of strength and conditioning programs and injury prevention programs.

Conclusion

Significant side-to-side asymmetries in bone mass, LBM and fat mass were observed in male and female soccer players, but the patten of asymmetry was not consistent between genders.

While we found no association between the degree of body composition asymmetry and LBP or LLI in our sample of collegiate soccer players, further studies are needed to extent and confirm our results.

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