BRIEF NOTE

Flexibility, torque and kick performance in soccer: Effect of dominance

Flexibilité, couple et coup de pied performant dans le football : effet de la dominance

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KEYWORDS
Soccer; Asymmetry; Knee joint

MOTS CLÉS
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Summary
Aim. — The aim of this study was to evaluate the knee flexor and extensor torques in isometric contractions, comparing the H:Q ratios, flexibility and maximal kick between dominant (DL) and non-dominant (NDL) limb of soccer players (SG) and active people (AG).

Methods. — Subjects performed maximal instep kicks with each limb, flexibility tests and maximal isometric voluntary contractions of the knee flexion and extension at 45° and 90° to determine peak torque of the DL and NDL. Knee flexion torque was divided by the knee extension torque to calculate torque ratios (H:Q ratio).

Results. — The flexibility and maximal kick in SG was significantly higher than in AG for both the DL and NDL (P < 0.05). The maximal kick of DL was significantly higher than in NDL in SG (P < 0.01). Knee flexion torque in SG was significantly higher than in AG in the DL (P < 0.05), and the H:Q ratio was similar between AG and SG.

Conclusion. — Dominance related differences were evident in the flexor torque and maximal kick for SG, probably related to the asymmetric demand in trainings, which present no effect on the flexibility.

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1. Introduction

Few soccer athletes develop bilateral movement and performance symmetry, with most players giving priority to one of the limbs. However, during the game, the soccer players are often forced to use one or another foot as the conditions dictate. Consequently, it is the essential importance of a similar conditioning and possible performance between dominant limb (DL) and non-dominant limb (NDL), what could facilitate certain actions during trainings and matches.

Due to the wide range of motion of the lower limbs during the trainings and matches, larger laxity in DL can be found compared to the NDL [1], while the flexibility may not change between the limbs [2]. Dominance also is influenced by the training routines, decreasing the force balance among the limbs [2], and presenting differences in instep kicks with maximal efforts [3,4] when comparing soccer players to untrained populations. In addition, for soccer players there is no consent about the DL showed higher knee flexor torque, which has been demonstrated to be different, or similar between limbs [1]. Thus, the aim of this study was to evaluate the knee flexor and extensor torques in isometric contractions, comparing the H:Q ratios, flexibility and maximal kicks between DL and NDL of soccer players and active people.

2. Materials and methods

A group of 10 healthy and physically active young men (AG $\pm 21.60 \pm 2.32$ years, $177.40 \pm 3.78$ cm and $72.40 \pm 2.30$ kg), not engaged in a regular training program and with no knee disorders, and 10 professional soccer players (SG $\pm 21.30 \pm 3.16$ years, $177.89 \pm 7.51$ cm and $69.70 \pm 10.18$ kg) of an sub elite team in São Paulo state championship volunteered for this study. The study was approved by the local Ethical Committee.

In the first session, subjects performed a field test in an official soccer field. Subjects were instructed to kick the ball, positioned on the line of the goal area maximally, as far as possible with each limb. The kick distance was measured (in meters) by the distance between the line of the goal area and the place where the ball touches the field surface.

In the second session, the hamstrings flexibility and knee flexor and extensor torques were measured. The Wells and Dillon’s test (in centimeters), and goniometry (in degree) for hip flexion of both limbs were used to measure the flexibility. Knee torque was accessed during four different positioning: knee extension in $45^\circ$ (KE45); knee extension in $90^\circ$ (KE90); knee flexion in $45^\circ$ (KF45); and knee flexion in $45^\circ$ (KF90), randomly distributed. The test was conducted in a specific chair developed to the isometric knee flexion or extension, in which the subjects were seated with an upright upper body position. Three 5 s maximal isometric voluntary contractions (MVC) were performed both for DL and NDL. The MVC force was accessed with a strain gauge (MM 200, Kratos Dinamometers, São Paulo, Brazil) at a sampling rate of 100 Hz. Force signals were analogic-to-digital converted, and to the data acquisition in a specific software (Aqados6, Lynx, São Paulo, Brazil) was used.

To verify the contraction effect (flexion × extension), dominance effect (DL × NDL) and joint position effect ($45^\circ$ × $90^\circ$) in the torque values, a three-way analysis of variance was applied, complemented by the Tukey test. To verify the dominance effect and joint position effect in the H:Q ratio, a two-way Anova was applied, complemented by the Tukey test. Student T-test was used to access the differences related to training status (AG × SG) in all the parameters studied. The level of statistical significance level was set at $P < 0.05$.

3. Results

Both flexibility tests (Wells and Dillon’s test, and goniometric test) demonstrated higher flexibility in SG compared to AG ($P < 0.05$). There were no significant differences between the limbs by the goniometric test (Table 1). Significant differences were found, for both limbs, between AG and SG for the maximal kick ($P < 0.01$) with SG presenting large distance in the kicks than AG (Table 1). There was significantly difference for maximal kick for the DL comparing to NDL in AG and SG ($P < 0.05$).
Table 1 Mean knee flexor/extensor torque ratio in 90° and 45°, instep kick with maximal efforts, and hip flexion goniometry to dominant limb (DL) and non-dominant limb (NDL), and flexibility Wells and Dillon’s test to active group and soccer players group.

<table>
<thead>
<tr>
<th></th>
<th>Active</th>
<th>Soccer players</th>
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<tbody>
<tr>
<td>Maximal kick</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DL</td>
<td>36.52 ± 5.67a</td>
<td>57.75 ± 6.10c</td>
</tr>
<tr>
<td>NDL</td>
<td>28.85 ± 8.22a</td>
<td>45.83 ± 7.86b</td>
</tr>
<tr>
<td>Knee flexor/extensor</td>
<td></td>
<td></td>
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<tr>
<td>90°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DL</td>
<td>0.38 ± 0.07b</td>
<td>0.42 ± 0.10b</td>
</tr>
<tr>
<td>NDL</td>
<td>0.40 ± 0.10b</td>
<td>0.42 ± 0.12b</td>
</tr>
<tr>
<td>45°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DL</td>
<td>0.67 ± 0.07</td>
<td>0.65 ± 0.15</td>
</tr>
<tr>
<td>NDL</td>
<td>0.71 ± 0.12</td>
<td>0.70 ± 0.13</td>
</tr>
<tr>
<td>Wells and Dillon’s test</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>24.16 ± 4.58a</td>
<td>37.5 ± 8.86</td>
</tr>
<tr>
<td>Goniometry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DL</td>
<td>75 ± 7.93a</td>
<td>85.7 ± 11.78</td>
</tr>
<tr>
<td>NDL</td>
<td>75.25 ± 6.14a</td>
<td>86.8 ± 13.41b</td>
</tr>
</tbody>
</table>

*Significantly different from soccer players group.
**Significantly different from 45° in the same limb.
†Significantly different from NDL of the soccer players group.

There were significant contraction effect \( P < 0.01 \) and joint position effect \( P < 0.01 \) in the torque for AG and SG only in the DL (Fig. 1). The KE90 torque was significantly higher than KE45 \( P < 0.01 \) and KF90 \( P < 0.01 \) for the both groups. Between limbs differences were found to flexion torque. The SG presented higher torque to the DL at KF45 and KF90 in relation to KF45 and KF90 of the NDL \( P < 0.05 \) for both analysis. In AG and SG, H:Q ratio in 45° was significantly higher than in 90° \( P < 0.05 \) (Table 1). No significant differences were found between the limbs for AG and SG in the NDL.

4. Discussion

The focus in the present study was to compare the flexibility, maximal kick and torque between DL and NDL in professional soccer players and active people. A few soccer trainings emphasizes a similar use of the lower limbs [3,4], what was also evidenced in the present study between limbs in the flexor torque of the soccer players. The flexibility can be a decisive factor in the performance as demonstrated by deficiencies on the kick in shortened soccer players in comparison with more stretched athletes, which also presented better force balance between limbs, and decreased the risk of knee injuries related to the stretch training [1]. In the same way, similarities, between the limbs, in the flexibility of the soccer players could be related to training routines [2].

Not surprisingly, maximal kick for soccer players was higher than for active subjects, reinforcing the training effects. Interestingly, no significant differences on the knee extensor torque were found between groups, which frequently have been associated with the kick performance. This evidence alerts to the fact that maximal voluntary contractions cannot be a good maximal kick predictor [2]. In addition, the results of the present study demonstrate that soccer trainings should not just privilege the strength, but also biomechanics aspects as the limb positioning for the kick, and the transfer of force to the ball. This emphasis could be important to reach an improvement on the kick efficiency in the both limbs [3,4]. Moreover, H:Q ratio reaches higher values in comparison to sedentary subjects [1]. This fact characterizes a larger force of the hamstrings, commonly associated at the knee joint stability. This way, neural adaptations related to soccer trainings also exists [1], leading to increases in the knee flexor and extensor torque, maintaining the knee joint stability preserved.

Figure 1 Torque values from dominant (top) and non-dominant (bottom) during extension in 90° (KE90) and 45° (KE45), and to flexion in 90° (KF90) and 45° (KF45) to actives and soccer players. *Significantly different from active players; †significantly different from soccer players; ‡significantly different from KF90; §significantly different from KE45.
5. Conclusion

In conclusion, dominance related differences were evident in the flexor torque and maximal kick for soccer players, probably related to the asymmetric demand in trainings, which present no effect on the flexibility. This way, soccer players presented better neuromuscular responses, however, differences related to dominance must be avoided, for a better performance and decreased injury risks.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

References