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BRIEF NOTE

The determination of functional asymmetries in the lower limbs of young soccer players using the countermovement jump. The lower limbs asymmetry of young soccer players

Asymétrie fonctionnelle des membres inférieurs chez des jeunes footballeurs lors d'un saut vertical

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Adolescent;
Soccer;
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Summary
Introduction. — This study investigated the functional asymmetries in the lower limbs of young soccer players using the countermovement jump (CMJ).
Synthesis of the facts. — Fifteen young soccer players were assessed on the CMJ using two unilateral dynamometric force platforms equipped with software for the analysis of the movement.
Conclusion. — The results indicate that the effects of functional asymmetries are important enough to require young soccer players to undergo a preventative screening before starting a sporting regime.

MOTS CLÉS
Adolescents ;
Football ;
Saut vertical en contre-mouvement ;

Résumé
Introduction. — Cette étude a permis d'examiner l'asymétrie fonctionnelle des membres inférieurs des jeunes joueurs de football lors d'un saut réalisé avec un contre-mouvement (CMJ).
Synthèse des faits. — Quinze jeunes joueurs de football ont été évalués au cours d'un saut vertical avec un CMJ, utilisant deux plateformes de force avec un logiciel pour l'analyse du mouvement.

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Blessure ;
Prévention

Conclusion. — Les résultats suggèrent l'importance d'effectuer chez les jeunes footballeurs une évaluation préliminaire avant de commencer l'entraînement sportif.

1. Introduction

The determination of functional asymmetries in the lower limbs constitutes a recent field of research aimed at the prevention of injuries in team sports [1]. The jump test, and in particular the countermovement jump (CMJ), does not only constitute an indicator of the levels of explosive force of the extensor muscles of the knee, but the information it provides may also be valid in terms of investigating injury prevention [2]. The vertical jump, measured by means of two unilateral force platforms, is considered to be a valid and reliable test, useful for evaluating and determining asymmetries in the lower limbs of athletes [3].

During the execution of the jump, the athlete reproduces some patterns of neuromuscular activation, such as concentric and eccentric contractions of the stretch-shortening cycle, which can be found in all the characteristic movements of team sport games, like cutting, side-stepping, braking and decelerating, accelerating and landing after a single-leg-jump.

In nearly all combat sports and in some team sports, certain asymmetries exist in the neuromuscular behaviours and uses of the lower limbs to achieve the specific movements required by the athlete for the discipline [1]. Soccer, in particular, is an asymmetrical type of sporting activity that imposes different tasks upon the lower limbs. This asymmetry also appears to affect the action of running as was highlighted in a recent study that analysed the differences in the plantar pressure between the two lower limbs in soccer players performing four typical movements of the sport: running, side-stepping, cutting and a jump with consequent landing [4]. The results of the study show that the soccer player is considerably committed to a preferred limb for the allocation of specific tasks with consequent increases in plantar pressure upon this limb compared to the contralateral limb [4].

The aim of the present study was to assess some of the force variables produced in the two lower limbs of young soccer players during the execution of the vertical jump (CMJ) using two unilateral dynamometric platforms.

2. Methods

The experimental sample comprised 15 young soccer players (age: 13.7 ± 0.3 years; height: 166.1 ± 5.5 cm; weight: 58.7 ± 4.3 kg) participating in a national youth championship for professional teams called ''Allievi Nazionali''; before data collection, all subjects and parents provided their informed consent in accordance with the University of Foggia's institutional Ethical Committee.

To evaluate the phases of the jump and the height of the elevation of the centre of gravity (COG), two unilateral dynamometric platforms were used (1000 Hz, Twin Plates, Globus Italia) integrated with computer software for the analysis of the movement (Tesys 1000, Globus Italia). Of the indicators supplied by the instrument, in addition to the height of the jump, only those most relevant for determining the following expressions of force were recorded: the duration of the eccentric phase (sec), peak eccentric force (N), peak concentric force (N) and the ground reaction force (GRF, N) for both the jumping and non-jumping leg.

All participants were familiar with and had previously performed the CMJ vertical jump test. Nevertheless, following the 20 min warm-up, consisting of 10 min slow running, 5 min lower limb stretching, 5 min skipping or skipping with a rope and three sub-maximal jumps, each participant then performed three jump-tests, with a 90° joint angle assessed using a goniometer, on the platforms with no arm swing, with a recovery time of 2 min between each jump in order to exclude the effect of learning [5]. Of the three jump-tests, the jump analysed in detail was the one exhibiting the greatest elevation of the subject's centre of gravity.

The mean, the standard deviation (SD) and the percent asymmetry between the two limbs were calculated for each parameter measured. The paired-sample two-tailed *t*-tests were performed to examine statistical differences between the jumping and non-jumping leg regarding the duration of the eccentric phase, the peak eccentric force, the peak concentric force and the ground reaction force. Differences were considered statistically significant when $P < 0.05$.

3. Results

The descriptive statistics (mean $\pm$ SD), the percent asymmetry and the results of Student's *t*-tests for paired observations (*t* statistic and *P* value) are reported in Table 1.

Paired *t*-tests revealed significant differences between the jumping and non-jumping leg for: the duration of the eccentric phase (s): $t = 9.339$, df = 14, $P < 0.001$ and the ground reaction force (N): $t = 4.622$, df = 14, $P < 0.001$. No statistically significant difference was found between the jumping and non-jumping leg for either the peak eccentric force ($t = -0.382$, df = 14, $P > 0.05$) or the peak concentric force ($t = 1.804$, df = 14, $P > 0.05$).

4. Discussion

This study focused on the determination of methodologies for assessing asymmetries between lower limbs and for assessing whether the training programmes employed by top level soccer players could also be effective in the young. This is important because the professional training age is one of

Table 1 Mean (± SD) values, the percent asymmetry and the results of Student's *t*-tests between jumping and non-jumping leg.

Source	Jumping leg (mean ± SD)	Non-jumping leg (mean ± SD)	% asymmetry	df	*t*	*P* value	*P*
Duration of the eccentric phase (sec)	0.16 ± 0.02	0.20 ± 0.02	20.0	14	9.339	0.000***	0.001
Peak eccentric force (N)	−5025.67 ± 1602.22	−4919.47 ± 1525.04	2.2	14	−0.383	0.708	NS
Peak concentric force (N)	7012.8 ± 888.1	6696.6 ± 118.8	4.5	14	1.804	0.093	NS
Ground reaction force (N)	5414.4 ± 243.2	3062.3 ± 296.8	43.5	14	4.622	0.000***	0.001

NS: non-significant; ***$P < 0.001$.

the variables important in the theoretical model of factors associated with functional asymmetry in soccer [6].

The results of the paired *t*-tests revealed that the different duration of the over-stretching phase in the non-jumping leg compared to that in the jumping leg could trigger the myotactic reflex to occur in the same eccentric phase rather than in the successive concentric phase, and carry a potential increased risk of injury. Although the paired *t*-tests reveal that the differences between the jumping and non-jumping leg for the peak eccentric and peak concentric force are not statistically significant, the data do suggest, however, that the young soccer players are able to produce slightly higher values in their jumping legs, but these differences cannot be generalised due to the small sample number in this study and the lack of analogous studies.

In this study, the jumping and the non-jumping legs present different values in reference to the duration of the eccentric phase, peak concentric force and the ground reaction force. Since the use of the unilateral dynamometric force platforms in such studies is very recent, it is not possible to compare the results obtained in the present study with other analogous investigations. This represents a limitation of the present study.

Even though the results of this study do not give a complete picture about functional asymmetries in the lower limbs of young soccer players, nonetheless, we can confirm that the CMJ lends itself well to functional evaluations and the determination of possible asymmetries between the lower limbs.

Results of this study suggest that a preventative screening before starting a sporting regime is required at least for young soccer players [7], and that further research are required to analyze the possible connections between the percent asymmetry and other morphological characteristics as the percentage of body fat or the length of the lower limbs.

Disclosure of interest

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

References

[1] Gstöttner M, Neher A, Scholtz A, Millonig M, Lembert S, Raschner C. Balance ability and muscle response of the preferred and non-preferred leg in soccer players. Motor Control 2009;13:218—31.
[2] Bubeck D, Gollhofer A. Load induced changes of jump performance and activation patterns in free drop jump exercise and sledge jumps. Eur J Sport Sci 2001;3:1—17.
[3] Impellizzeri FM, Rampinini E, Maffiulletti N, Marcora SM. A vertical jump force test for assessing bilateral strength asymmetry in athletes. Med Sci Sports Exerc 2007;39:2044—50.
[4] Wong P, Chamari K, Chaouachi A, Wei Mao D, Wisløff U, Hong Y. Difference in plantar pressure between the preferred and non-preferred feet in four soccer-related movements. Br J Sports Med 2007;41:84—92.
[5] Noyes FR, Barber-Westin SD, Fleckenstein C, Walsh C, West J. The drop jump screening test. Am J Sports Med 2006;33:197—207.
[6] Fousekis K, Tsepis E, Vagenas G. Lower limb strength in professional soccer players: profile, asymmetry and training age. J Sports Sci Med 2010;9:346—73.
[7] Hewett TE, Myer GD, Ford KR, Slauterbeck JR. Preparticipation physical examination using a box drop vertical jump test in young athletes; the effects of puberty and sex. Clin J Sport Med 2006;16:298—304.