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Relationship of speed and unilateral vertical jump performance of basketball athletes

Relação entre a velocidade e desempenho de salto vertical unilateral de atletas de basquetebol

Ygor Gabriel Almeida do Nascimento[1]
https ://orcid.org/0000-0001-8691-1988
Cristiano Souza de Faria[1]
https ://orcid.org/0000-0002-6961-4225
Leonardo Emmanuel de Medeiros Lima[2]
https ://orcid.org/0000-0003-3182-9316
Roberta Luksevicius Rica[3]
https ://orcid.org/0000-0002-6145-1337
Danilo Sales Bocalini[4]
https ://orcid.org/0000-0003-3993-8277
Aylton Figueira Junior[2]
https ://orcid.org/0000-0001-8069-2366
Vinicius Tonon Lauria[1,5]
https ://orcid.org/0000-0002-8538-8723
Dilmar Pinto Guedes Júnior[5,6]
https ://orcid.org/0000-0001-5430-4489
Rodrigo Pereira da Silva[5,7]
https ://orcid.org/0000-0002-1020-3392

Abstract - Basketball is a sport practiced around the world in this way, performances tests especially with low-cost and accessible are suggested to adjust the training. The 00aim of present study was to evaluate and correlate the speed and jump performance of lower limbs of basketball athletes from the Praia Grande, city of São Paulo, Brazil. Twelve male athletes (6.92 ± 2.57 years of pratice) from the Basketball team of Praia Grande City, aged 18.7 ± 0.6 years, height 1.85 ± 0.06, body mass 83.66 ± 10.16 kg were evaluated. The athletes were submitted to test sessions using the protocol for evaluating the maximum speed of 20 meters and the unilateral vertical jump. The speed on 20 meter test was 3.53 ± 0.20 seconds. Although an asymmetry of 17.81 ± 14.64% was found, no statistical difference (p = 0.817) was found between the dominant (36.50 ± 7.36 cm) and non-dominant (35.92 ± 5.63 cm) of vertical jump performance. Additionally, correlation between 20-meter test and values jump was found to dominant leg (p = 0.042) but not to non-dominant leg (p = 0.704). In conclusion, although asymmetry was found between members of the dominant and non-dominant side of the pitch, did not show any difference in the vertical jump.

Key words: Muscle power; Performance; Velocity; Jump.

Resumo - *O basquete é um esporte praticado em todo o mundo, desta forma, testes de desempenho principalmente com baixo custo e acessíveis são sugeridos para adequar o treinamento. O objetivo do presente estudo foi avaliar e correlacionar a velocidade e o desempenho de salto de membros inferiores de atletas de basquetebol da cidade da Praia Grande, São Paulo, Brasil. Foram avaliados 12 atletas do sexo masculino (6,92 ± 2,57 anos de prática) da equipe de Basquetebol da Cidade de Praia Grande, com idade 18,7 ± 0,6 anos, estatura 1,85 ± 0,06, massa corporal 83,66 ± 10,16 kg. Os atletas foram submetidos a sessões de testes utilizando o protocolo de avaliação da velocidade máxima de 20 metros e do salto vertical unilateral. A velocidade no teste de 20 metros foi de 3,53 ± 0,20 segundos. Embora tenha sido encontrada uma assimetria de 17,81 ± 14,64%, não foi encontrada diferença estatística (p = 0,817) entre o desempenho do salto vertical dominante (36,50 ± 7,36 cm) e não dominante (35,92 ± 5,63 cm). Além disso, foi encontrada correlação entre o teste de 20 metros e os valores de salto para perna dominante (p = 0,042), mas não para perna não dominante (p = 0,704). Em conclusão, embora tenha sido encontrada assimetria entre membros do lado dominante e não dominante do campo, não houve diferença no salto vertical*

Palavras-chave: *Potência muscular; Desempenho; Velocidade; Salto.*

1 Faculdade Praia Grande. Praia Grande, SP. Brasil.
2 Universidade São Judas Tadeu. São Paulo, SP. Brasil.
3 Faculdade Estácio de Sá. Vitória, ES. Brasil.
4 Universidade Federal do Espírito Santo. Vitória, ES. Brasil.
5 Universidade Metropolitana de Santos. Santos, SP. Brasil.
6 Universidade Santa Cecília. Santos, SP. Brasil.
7 Universidade Federal de São Paulo. Santos, SP. Brasil.

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Corresponding author
Rodrigo Pereira da Silva.
Universidade Metropolitana de Santos
Avenida Conselheiro Nébias, 536, 11045-002, Santos (SP), Brasil.
E-mail: r.pereirads@hotmail.com

INTRODUCTION

According to the International Basketball Federation[1], currently there are approximately 450 million basketball players and fans in the world. In Brazil, approximately 35 million are involved with the modality and 3 million practitioners[2]. Around physical capacity and motor skill at basketball, the jump performance had been considered the important component to athlete's to influence the outcome in competitions. The high frequency of jumps, especially during the game, can promote muscle imbalance, especially to the quadriceps femoris, generating an overload on the knee joint in sports[3].

Bishop et al.[4] evaluated the symmetry in the jump of young elite female soccer players in the United States and correlated it with their maximum sprint performance, showing that asymmetric results are related to poor performance in the 20-meter speed test. In sports such as basketball, which constantly requires vertical jumps, having excellent muscle power becomes essential, especially for facilitating shots, rebound successes or blocking an opponent's shot, which can be decisive for the success of a match[5]. Like jumping, speed is of great importance for the specificity of the sport.

Its is known that basketball is considered a sport of acyclic and intermittent character, with times when there is a need for short distance displacements at high speed, as a counter-attack, or for the search for a defense reorganization when it suffers the counter -attack[6,7]. Thus, considering the importance of speed and muscle power, the aim of this study was to evaluate the asymmetry and correlate the speed and vertical jump performance of basketball athletes.

METHODS

Subjects

Twelve male athletes from the Basketball team of the City of Praia Grande-SP, aged 18.7 ± 0.6 years, height 1.85 ± 0.06 meters, body mass 83.66 ± 10.16 kg and practice time 6.92 ± 2.57 years participate voluntarily of study. Of these athletes, eight were considered right-handed and four left-handed, the dominance side being considered from the arm with which the athlete shoots. Of the 12 athletes, two act as guards, 2 guards, 4 wings, 2 pivots and 2 pivots, all participating in the under-20 basketball team, which compete in the Regional Games and the Open Interior Games, representing the city.

Among then, 10 subjects perform strength training 4.2 ± 0.6 days a week and seven reported that they had some injury, 5 in the lower limbs. According to the resolution of the National Health Council, only participants who gave their free and informed consent in writing were admitted to the study in concordance with ethical committee (1.598.072).

Parameters evaluated

Anthropometry

The body mass was evaluated using a digital scale with a capacity of up to 180 kg. The height was evaluated by mobile Wiso® brand stadiometer with a

maximum average of up to 210 cm. The body mass index (BMI) was calculated according to the equation BMI = body mass (kg) / height (m2).

Velocity test

The 20-meter running test was used to assess speed according to Johnson & Nelson[8]. Briefly, before the test, all athletes performed a modality-specific warm-up for around 5 minutes, without the interference of the evaluators. After the warm-up, one athlete at a time was called to position themselves behind one of the lanes that marked the basketball court, where there were two cones positioned in a straight line 20 meters away from this same lane with a distance of 2 meters between the cones. At the evaluator's signal, the athlete covered the 20 meters at maximum speed, and the time after overtaking between the cones was measured. The shortest time of three attempts was used as a parameter.

Unilateral vertical jump test

To assess the performance of the lower limbs, the unilateral vertical jump test protocol adapted in accordance with Lockie et al.[9] was used. After warming up and familiarizing with the test, all athletes were instructed to position themselves in front of the evaluators who were carrying an iPhone 8 cell phone using the My Jump[10] application. The athletes were instructed to do a knee semi-flexion, with the spine erect, and at the evaluator's signal they jumped as high as possible. There were three attempts for each leg (dominant and non-dominant side) and the highest jump of each leg was recorded. The equation used to assess bilateral asymmetry was: Bilateral asymmetry = (best leg - worst leg) / best leg*100.

STATISTICAL ANALYSIS

After confirming of data normality by dominant and non-dominant leg jump, the Student's t test was used to compare the values of jumps. The Person correlation test was performed to analyses the relation between the jumps performance and 20 meters performace test. Analyzes were performed using GraphPad Prism 5.0 statistical software (San Diego, CA, USA) and data presented as mean ± standard error with significance of $p \leq 0.05$.

RESULTS

The players' speed at 20 meters test was 3.53 ± 0.20 seconds. In Figure 1A it is showed the values related to the performance in the unilateral jump of both legs. Although an asymmetry of 17.81 ± 14.64% was found in the performance of the vertical jump, no statistical difference was found ($p= 0.817$; $t= 0.235$; $df= 11$; 95% CI= -6.025 to 4.858) between the dominant (36.50 ± 7.36 cm) and non-dominant (35.92 ± 5.63 cm) leg.

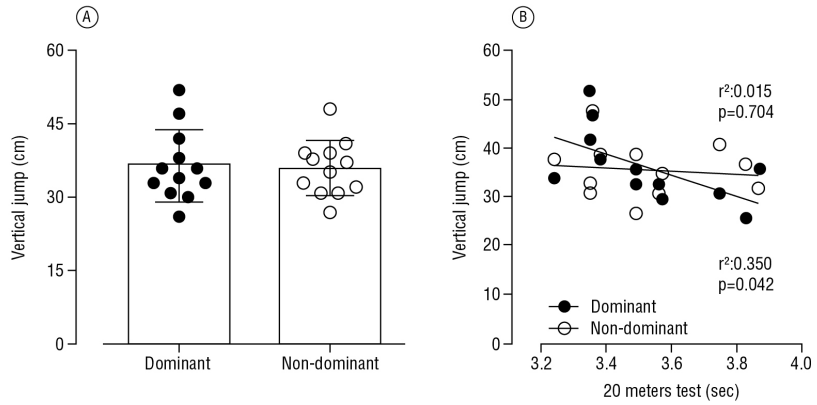

Figure 1. Panel A: values expressed in mean ± standard deviation of vertical jump by dominant and non-dominant legs. Panel B: Person correlation of 20 meters test performance and vertical jump performance of dominant (●) and non-dominant (○) leg.

As can be seen in Figure 1B, a correlation was found between the performance of the 20-meter test and jump performance of dominant leg (p= 0.042; r2: 0.350; 95% CI: -0.870 to -0.027) but not with the non-dominant leg (p=0.704; r2: 0.015; 95% CI: -0.650 to 0.704). Additionally, the asymmetry values did not correlate with the performance of 20-meter test performance (p= 0.326; r2: 0.096; 95% CI: -0.320 to 0.750).

DISCUSSION

In high performance, we know that the requirements of physical fitness and physical conditioning are extremely important factors for an athlete to achieve maximum performance. The muscles of the lower limbs need to develop maximum strength (dynamic and static), explosive (power) and endurance[11]. The quadriceps has a dominance when it comes to recruiting muscle fibers responsible for knee flexion and extension, due to its greater need, both in daily life and in sport[12]. Thus, morphofunctional tests are often used in sports teams for evaluation of performance, the evaluation of the power of lower limbs in sport has been receiving a lot of attention. The evaluation using the force platform is considered a reference in the evaluation process[3], however the accessibility and cost make it difficult to carry out more studies and access, thus, low cost tests, easy execution and access for all audiences are used, with emphasis on the horizontal and vertical jump tests[13,14].

Although no statistical difference was found between the vertical jump of dominant and non-dominant legs, an asymmetry of 17.81% was found, a result higher than the 10% maximum proposed as ideal by other studies[15,16]. Fort-Vanmeerhaeghe et al.[17], evaluating volleyball and basketball players, found mean asymmetries of 12.84 ± 7.16%, however, 33% of the sample presented asymmetry greater than 15%. Read et al.[18], evaluating elite male soccer players, demonstrated that asymmetry resulted in a higher risk of lower limb injuries.

About performance, Bishop et al.[4], analyzing the performance of elite soccer players in the 20-meter test and in the jump, demonstrated that the unilateral vertical test is the most appropriate to identify asymmetry compared to the horizontal jump, triple jump and cross jump. Additionally, the authors

demonstrated that the asymmetry between the lower limbs is related to a lower performance in the sprint, unlike our study, which found no correlation with the asymmetry, but only with the leg on the dominant side.

High-level sports such as basketball end up determining body patterns that go beyond an exercise routine for non-athletes, resulting in musculoskeletal changes that are associated with the efficiency of the sportive gesture[19]. Unlike the results found in our study, there was no difference in vertical jump between the dominant and non-dominant legs. This result was interesting, especially when we consider the pattern of the motor gesture often used in throws with the leg opposite the dominant hand as a reference in the jump impulse, however, it is necessary to consider that during the throw both legs can be requested explaining in part this similarity, along with physical preparation

Gantois et al.[20] evaluated college basketball athletes and showed a correlation between maximum sprint and vertical jump. In our study we demonstrated positive correlations only with the dominant side leg, which can be interesting especially when we consider that this leg traditionally plays a primary role in the beginning of sprint acceleration.

In the study by Fort-Vanmeerhaeghe et al.[17] analyzing the relationship between asymmetries between limbs in unipodal tests against movement and horizontal and the performance of 30-meter sprints in 81 basketball, volleyball and handball athletes demonstrated significant relationships between asymmetries in the single-legged jump against movement and time of sprint. Bishop et al.[15], evaluating female soccer players in the single-leg vertical jump and sprint speed of 10 and 30 meters, showed that asymmetries between limbs were significantly associated with slower performance in the test.

Some limitations of the study must be mentioned as the total number of subjects as well as the tests used in this study do not allow generalizations and therefore the findings must be carefully analyzed.

CONCLUSIONS

Thus, further studies must be conducted to confirm our findings.In conclusion, although asymmetry was found between the limbs of the dominant and non-dominant sides of the throw did not show any difference in the vertical jump.

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COMPLIANCE WITH ETHICAL STANDARDS

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Ethical approval

Ethical approval was obtained from the local Human Research Ethics Committee Federal University of São Paulo – and the protocol (no. 5.320.478) was written in accordance with the standards set by the Declaration of Helsinki.

Conflict of interest statement

The authors have no conflict of interests to declare.

Author Contributions

Conceived and designed experiments: RPS, DPGJ; Performed experiments: YGAN, CSF, LEML; Analyzed data: VTL, AFJ; Contributed with reagents/materials/analysis tools: DSB; Wrote the paper: RLR.

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