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ORIGINAL ARTICLE

Estimated aerobic power, muscular strength and flexibility in elite Brazilian Jiu-Jitsu athletes

Estimation de la puissance aérobie, de la force musculaire et de la souplesse chez des athlètes d'élite de Jiu-Jitsu brésiliens

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KEYWORDS

Physical evaluation;
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Summary

Objective. – This study was designed to estimate the maximum oxygen uptake, muscular strength and flexibility of elite Brazilian Jiu-Jitsu athletes.

Methods. – The sample consisted of eleven Brazilian Jiu-Jitsu athletes (25.8 ± 3.3 years old) who were medallists at national and/or international competitions. The aerobic power was estimated by a treadmill test, according to the Bruce Protocol. The maximal isometric strength (hand, leg and back) was measured by specific dynamometric tests. We used sit-ups and push-ups to evaluate abdominal and upper limb strength endurance, respectively. We applied the sit-and-reach test to determine hip, back and posterior flexibility of the muscles of the lower limbs.

Results. – We observed a VO_{2max} of 49.4 ± 3.6 mL/kg per minute for the treadmill test. We observed measures of 43.7 ± 4.8 kgf for the right maximal isometric handgrip strength, 40.1 ± 3.8 kgf for the left maximal isometric handgrip strength, 185.5 ± 36.0 kgf for the maximal isometric back strength and 154.3 ± 41.9 kgf for the maximal isometric leg strength. In the strength endurance test, the athletes performed 52 ± 7 repetitions in a 1-min sit-up test, and 40 ± 8 repetitions in the push-up test. In the sit-and-reach test, the athletes had an average score of 36 ± 9 cm.

Conclusions. – The elite Brazilian Jiu-Jitsu athletes had medium aerobic power and flexibility, excellent abdominal and upper body strength endurance and maximal isometric back strength. However, these athletes did not have high maximal isometric handgrip or leg strength.

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MOTS CLÉS

Évaluation physique ;
Condition physique ;
Haute performance

Résumé

Objectif. – Cette étude visait à estimer la consommation maximale d’oxygène, la force musculaire et la souplesse chez des athlètes d’élite de Jiu-Jitsu brésiliens.

Méthode. – L’échantillon était composé de onze athlètes de Jiu-Jitsu (âge : $25,8 \pm 3,3$ ans) médaillés dans des compétitions au niveau national et/ou international. La puissance aérobie a été estimée par le test sur tapis roulant selon le protocole de Bruce. La force maximale isométrique (à la main, jambes et dos) a été mesurée par des tests spécifiques au dynamomètre. *Sit-ups* et *push-ups* ont été utilisés respectivement afin d’évaluer la force des muscles abdominaux et des membres supérieurs. Souplesse de la hanche, du dos et des muscles des jambes ont été déterminés par le test de flexion du tron (*sit-and-reach test*).

Résultats. – Le VO_{2max} sur test sur tapis roulant est de $49,4 \pm 3,6$ mL/kg par minute. On observe des valeurs de $43,7 \pm 4,8$ kgf sur la poignée droite et de $40,1 \pm 3,8$ kgf pour la force à la poignée gauche, $185,5 \pm 36,0$ de force maximale isométrique kgf pour le dos, et $153 \pm 41,9$ kgf pour la force isométrique des jambes. Pour évaluer la résistance du muscle, les athlètes ont effectué 52 ± 7 répétitions de *sit-ups*, et 40 ± 8 répétitions de *push-ups*. Lors du test de flexion du dos, les athlètes ont obtenu un score moyen de 36 ± 9 cm.

Conclusion. – Il a été constaté que les athlètes d’élite de Jiu-Jitsu brésiliens ont une puissance aérobie et une souplesse moyennes, une grande force abdominale, des membres supérieurs et une force isométrique maximale du dos. Cependant, ils n’ont pas une force maximale de préhension ainsi qu’au niveau des jambes.

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1. Introduction

Brazilian Jiu-Jitsu is a Brazilian sport that originated by adapting techniques from traditional Japanese jujutsu, which was used by samurai to defend the homeland and its feudal lords [1]. These adaptations occurred around 1920 [2].

However, the rise of Brazilian Jiu-Jitsu began with the creation of the World Jiu-Jitsu Championship in Rio de Janeiro in 1996. The first eleven editions of this championship took place in Rio de Janeiro. In 2007, the twelfth World Jiu-Jitsu Championship was held outside of Brazil for the first time. This was a major achievement for the sport and was unavoidable due to the popularisation of Brazilian Jiu-Jitsu [3].

Although Brazilian Jiu-Jitsu has acquired thousands of fans, there have only been a few scientific studies designed to try to understand the physiological demands involved in the sport [4–6]. The lack of knowledge results in an empirical character of the training prescription and planning applied to Brazilian Jiu-Jitsu.

To quantify mechanical work during the combat sports, there are some limitations. Faced with this reality, the physical abilities used in this kind of sport should be measured [7]. The common perception in combat sports is that high levels of aerobic power and capacity allow athletes to maintain a high intensity throughout the match, delay H^+ and Pi accumulation and have a better/faster recovery between matches [8].

In addition to aerobic capacity, Brazilian Jiu-Jitsu athletes need high isometric strength endurance, which is used to keep a good hold on an opponent and apply a submission technique [5]. Upper body isometric strength is important because the techniques generally involve extreme contact and do not provide space for dynamic movements [9]. Handgrip strength endurance also seems to be important for good athletic performance, because the ath-

lete has to be able to hold the opponent’s uniform (*gi*) [6,10].

Another relevant physical component of Brazilian Jiu-Jitsu is the flexibility, specifically in the trunk and hamstrings that is required to perform specific movements. Good flexibility can facilitate the learning of motor gestures [11,12]. Accordingly, Yoon [13] noted that flexibility levels could differentiate the performances of combat athletes, and wrestlers with a higher competitive level have shown greater flexibility compared with low-level wrestlers.

Thus, the aim of this study was to describe the levels of aerobic power, strength endurance and flexibility of elite Brazilian Jiu-Jitsu athletes.

2. Methods**2.1. Samples**

The sample consisted of eleven elite Brazilian Jiu-Jitsu male athletes (25.8 ± 3.3 years old) who belonged to adult male categories and graduations of black and brown belts. To be part of this group, the athletes needed to be medallists at national and/or international competitions. These eleven athletes were divided into the following categories based on their weight:

- one was a feather weight (up to 67 kg);
- four were light weights (73 kg);
- three were middle weights (79 kg);
- two were heavy weights (up to 91 kg);
- one was a super heavy weight (up to 97 kg).

One athlete was excluded from the treadmill test, and two athletes were excluded from the back and leg dynamometric tests. These athletes still participated in the other tests and were only excluded from the tests mentioned

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