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ORIGINAL ARTICLE

Relationship between isokinetic and explosive strength among elite Tunisian taekwondo practitioners

Relation entre la force isocinétique et la force explosive chez des taekwondistes de haut niveau

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KEYWORDS
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Summary
Objective. — To investigates into the relationship between concentric isokinetic strength and explosive force of the knee extensors among elite taekwondo players.
Materials and methods. — Fifteen senior male taekwondo players performed an Isokinetic Test at two different angular velocities (i.e., 60°/s and 180°/s) and a Five-Jump Test (5JT). The isokinetic parameters are the peak torque (PT), the average power (AP), the acceleration time (AT) and the peak torque time (TPT). 5JT variables are the absolute performances, relative to the lower limb size and related to body mass performances.
Results. — The performance in the horizontal expansion of taekwondo athletes is correlated to the quadriceps concentric isokinetic strength parameters. The PT and AP are correlated to the performance of 5JT brought back in the athlete's body mass, for the two speeds ($P < 0.05$). The TPT is correlated with a lower limbs length for the slow speed (60°/s). No significant correlation between the AT and all 5JT values for both test speeds.

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Conclusion. — The size of the lower limbs and body mass athlete are so critical in 5JT performance and isokinetic testing speeds selected. The 5JT can be an effective way to evaluate the explosive strength of the lower limbs (i.e., flexors/extensors of hip, knee and ankle) predominately in taekwondo players.

MOTS CLÉS
Corrélation ;
Évaluation ;
Muscles du genou ;
Force ;
Sport de combat

Résumé
Objectif. — Étudier la relation entre la force isocinétique concentrique et la force explosive des extenseurs du genou chez des taekwondoïstes élites.
Méthodes. — Quinze taekwondoïstes élites seniors masculins, ont effectué un test isocinétique à deux vitesses angulaires (60°/s et 180°/s) et un test de cinq bonds successifs « Five-Jump Test » (5JT). Les paramètres isocinétiques retenus sont le moment de force maximal (MFM), la puissance moyenne (PM), la durée d'accélération (DA) et le temps du MFM (TMFM). Les variables du 5JT sont les performances, absolue, relative à la taille des membres inférieurs et rapportée à la masse corporelle.
Résultats. — La performance des taekwondoïstes dans la détente horizontale est corrélée aux paramètres de la force isocinétique concentrique des quadriceps. Le MFM et la PM sont corrélés à la performance du 5JT rapportée à la masse corporelle, pour les deux vitesses ($p < 0,05$). La DA est corrélée à la longueur des membres inférieurs pour la vitesse (60°/s). Pas de corrélation entre la DA et toutes les variables du 5JT pour les deux vitesses isocinétiques.
Conclusion. — La taille des membres inférieurs et la masse corporelle sont déterminantes dans la performance du 5JT et du test isocinétique aux vitesses choisies. Le 5JT pourrait constituer un moyen efficace pour évaluer la force explosive des muscles fléchisseurs-extenseurs de la hanche, du genou et de la cheville, pour les taekwondoïstes.

1. Introduction

Taekwondo is a martial art of Korean origin, which in recent years was developed into an Olympic combat sport [1]. Although, taekwondo competition has received both international and Olympic recognition, several researches into the physiological demands of this combat sport are in their infancy [1,2].

The study of forces types as the movements developed by the lower limbs (principal actor of kicks in taekwondo competition) is one of the factors affecting the realization of a high performance in taekwondo competition [3,4]. Taekwondo athletes use fast kicks with devastating power of high amplitude focused on the opponent's head and torso. This requires intensive use of knee extensor and flexor muscles [5,6] and makes the kinetics of the knee extensors as the main factor in the kick success [7]. In this context, a study of Chiu el al. [8] dealed with the analysis of the biomechanical characteristics of muscular power in taekwondo in terms of optimizing the performance even through the design and creation measurement systems or for the prevention of muscle injury. As well, a recent study of Machado et al. [3] analyzed the performance of knee extension and flexion of taekwondo and kickboxing athletes and showed that muscular enhancement capacity is not only related to the power capacity of contraction but also to motor coordination.

The Isokinetic Test is an objective and quantitative muscle testing in the joints selected [9], and the Five-Jump Test (5JT) is an interesting valid and practical field test [10], which both allow us for the evaluation of isokinetic and the explosive strength respectively, contributed significantly in this analysis.

Thus, the aim of our study is to determinate whether there is a relationship between isokinetic concentric strength and explosive force of the knee extensors measured using the tests cited before (i.e., the isokinetic and the Five-Jump Test) among taekwondo athletes.

2. Materials and methods

2.1. Experimental approach to the problem

The study was designed as a determination if there is a relation between the isokinetic performances and 5JT performance among well-trained taekwondo practitioners.

2.2. Participants

A sample of 15 Tunisians taekwondo senior male was recruited from the Tunisian national team. Table 1 presents the anthropometric characteristics of the athletes expressed in means and standard deviations (±SD). Taekwondo athletes were at least black belt (first Dan) with a practice experience of 7.9 ± 0.91 years and a well-developed technical level. In addition, they were exercising for 9 sessions comment per week and they participated regularly at least for 2 years in official taekwondo competitions before the study. All athletes did not present any health restriction or any cons-indication for the realization of isokinetic tests [i.e., presence of any pathology (e.g., intercurrent, cardiac, pulmonary or metabolic diabetes)] and no member suffered from sport accident or previous injury in the lower limbs at least during the 6 months preceding the tests. Only the length of the preferential member, which