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De Haan, A., De Ruiter, C. J., Tsolakidis, E.

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OPTIMAL FORCE-VELOCITY PROFILES IN ELITE ATHLETES

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Introduction Velocity, strength and power are determinant factors of performance in many activities. Protocols using loaded squat jump have been designed to evaluate those capabilities and calibrate precisely training programs. Estimating the optimal ratio between velocity and force production is also a main concern in explosive oriented tasks (Vandewalle et al. 1987). Recent methods have been proposed to determine the optimal force-velocity profile in ballistic movements (Samozino et al. 2008, 2012). Thus, the purpose of this study was to compare the actual force-velocity relationship of elite athletes to their optimal force-velocity profile. Methods A cohort of 100 cycling, fencing, rowing, taekwondo and track and field elite athletes (48 females, 52 males), including Olympic medalists, participated in this study. Lower limb force-velocity profiles were evaluated for each athlete. They performed squat jumps with 0, 10, 20 30, 40, 50 and 60% of the maximal external load they were able to lift. Theoretical, maximal power (Pmax), force (Fmax) and velocity (Vmax) were determined from the individual force-velocity relationships. Optimal profiles were assessed by calculating the optimal force (Fopt) and optimal velocity (Vopt). Student paired t-tests were performed to compare Vmax and Fmax with Vopt and Fopt, respectively. One-way ANOVAs were performed to compare the difference between measured and optimal profile in the considered activities. Results We observed significant differences between Vmax, Vopt and Fmax, Fopt ($p<0.05$). ANOVA revealed an effect of activity on the difference between maximal and optimal force ($p<0.01$) and velocity values ($p<0.01$). Fencers, track and field and taekwondo athletes presented more optimized profile than rowers and cyclists ($p<0.05$). Discussion As all the measured profiles were different from the optimal ones, it seems that even in elite athletes muscular profiles are not optimized. These results must be nuanced by the fact that squat jump might not be the more suitable method to evaluate the specific demand of each activity. Indeed specific protocols (e.g., cycling tests for cyclists) could have shown different findings. Moreover, the level of optimization of the profile depends on the activity, suggesting that further investigations are needed to determine if the optimization of force-velocity profile could effectively enhance performance in explosive activities. References Samozino P, Rejc E, Di Prampero PE, Belli A, Morin JB (2012). Med Sci Sports Exerc 44 (2):313-22. Samozino P, Morin JB, Hintzy F, Belli A (2008). J Biomech 41 (14):2940-5. Vandewalle H, Peres G, Heller J, Panel J, Monod H (1987). Eur J Appl Physiol O 56 (6):650-6.

EFFECT OF INTERMITTENT JUDO TEST ON UPPER LIMBS STRENGTH PERFORMANCE

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Introduction Judo is a sport characterized by brief bouts of high intensity, intermittent exercise that requires neuromuscular performance (Bonitch-Góngora et al., 2012). These repeated high intensity match after match cause major episodes of fatigue in the judoka. There is a gap in studies concerning the maintenance of intra-fighting strength and its relationship with other variables specifically required in a judo contest. This study aims to determine the effect of fatigue on arm extensor muscles upon power, velocity, strength and rate force development (RFD) output levels, throughout a simulate contest in judo athletes. Methods Sixty-three male judo athletes of five national teams participated in this study, and were classified in two performance groups (top-elite, n=30; elite, n=33). All participants performed an intermittent judo test - the COPTEST (García-García et al., 2007), a 5 minutes duration test, with 9 Nage-komis, 9 Uchi-komis, 9 Jujigatame and 4 repetitions of Bench-press (BP) with the power-load (~50%1RM) in each minute (T1 to T5). BP load was the previous calculated power-loadings of the arm extensor muscles, and 4 measures were collected: force; power; velocity; and RFD. Power-load was tested on a free-weights BP exercise, and an Isocontrol – Dynamic 5.1 Software was used to collect data. Standard statistical methods, one-way ANOVA, and the repeated measures analysis of variance were used. Results Significant differences were observed between: (1) performance groups in power, strength and RFD (top-elite athletes were powerful, stronger and have more explosive strength of arms; all, $p <.001$); (2) evaluations (T1 to T5) in strength, power, velocity, and RFD. Moreover, the effect of fatigue on power, strength, velocity, and RFD (all, p =NS) is independent of the performance group. Discussion In accordance, the maximization of the power development capacity must be a key component of judo training programs. Nevertheless, during the contest, the observed slight reduction in power and velocity (in both, top-elite and elite groups) must be investigated (i.e., changes in the contractile apparatus vs reduced muscle activation).

COUNTER MOVEMENT JUMP PERFORMANCE IN 12-14 YEARS OLD BOYS AND GIRLS; THE INFLUENCE OF DIFFERENT SPORT EVENTS.

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Introduction: Counter movement jump (CMJ) has been used to evaluate neuromuscular performance in many athletes. The type of sport event and the training background seems to influence CMJ performance in adult athletes. The aim of this study was to measure counter movement jump height in 12-14 years old boys and girls on a 3-year follow-up study based on different sport events. Methods: A total of 75 young athletes participated in the study (boys=44; girls=31) representing three different sport events (boys= basketball, handball, soccer; girls=basketball, handball, track & field). Data were obtained within a period of three years, one measurement per year; the subjects were12 years old at the first year and 14 years old at the last year of the measurements. The height of the CMJ was recorded and peak power values were calculated. Results: Boys' performance increased significantly between consecutive years (12-13 yrs: 15.6%; 13-14 yrs: 9,5%), while girls' performance didn't show any significant change. At 13 and 14 years age groups differences between boys and girls were significant. Estimated peak power changed significantly in both genders between consecutive years (boys: 12 yrs 2586±648; 13 yrs 3254±727; 14 yrs 3777±788 and girls: 12 yrs 2796±597; 13 yrs 3074±464; 14 yrs 3263±365 w). Based on their sport events boys basketball players showed significantly higher performance in CMJ but there were no differences in estimated peak power. The differences in CMJ were present from the younger age group through the oldest age group, however all groups had a similar improvement rate. In girls there were no differences between the three different sport events at any age group. Discussion: The improvement in CMJ performance and estimated peak power was well recorded for boys, but not for girls. The latter had no improvement in the CMJ, however peak power had a significant improvement within the 3 year period of the study. The lesser increase in muscle mass that girls experience in this age period, with the increase in total body mass, perhaps indicate a higher need for muscular development and for neuromuscular training. The examined sport events seem not to influence improvement rate in CMJ, nor in estimated peak power at this age period.

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EFFECT OF INTERMITTENT JUDO TEST ON UPPER LIMBS STRENGTH PERFORMANCE

This study aim:

To determine the effect of fatigue on arm extensor muscles upon power, velocity, strength and rate force development (RFD) output levels, throughout a simulate contest in judo athletes.

Methods

Participants
Sixty-three male judo athletes of five national teams (top-elite, n=30; elite, n=33).

Fitness evaluation
The COPTEST (García-García et al., 2007; Fig.1).

Power-load was tested on a free-weights BP exercise, and an Isocontrol – Dynamic 5.1 Software was used to collect data.

Statistical analysis
One-way ANOVA, and the repeated measures analysis of variance.

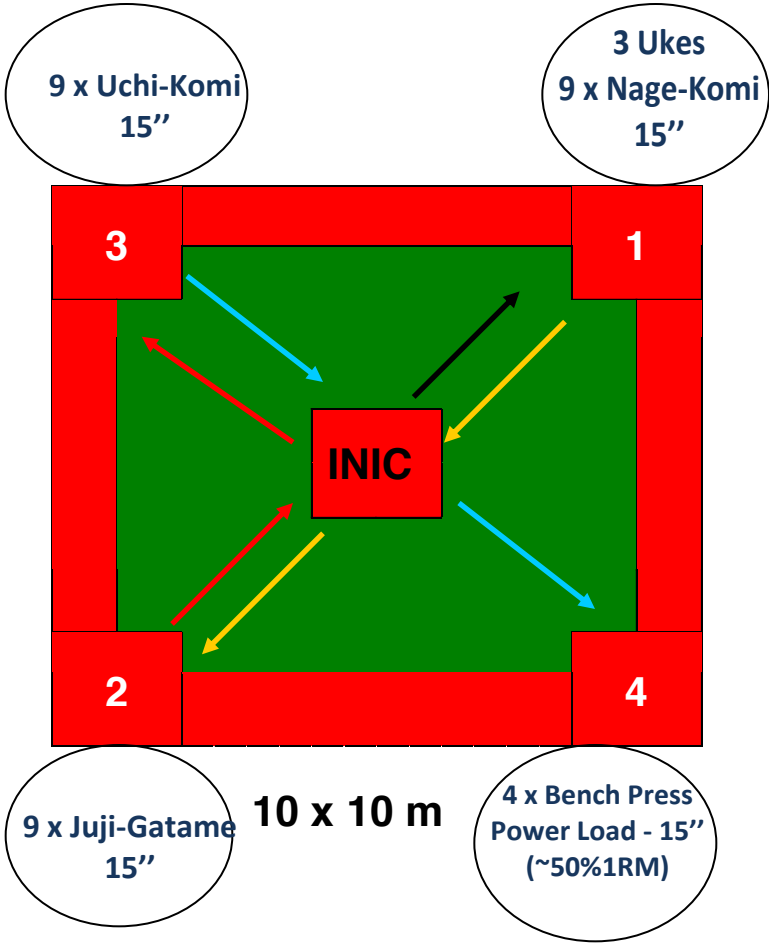

Figure 1. The COPTEST protocol.

Results

Top-elite athletes were powerful (+69 W to 200 W), stronger (+69 N to 184 N) and have more explosive strength of arms (+15778 $N.s^{-1}$ to 32648 $N.s^{-1}$) (all, $p < .001$);

The effect of fatigue on power, strength, velocity, and RFD (all, p =NS) is independent of the performance group.

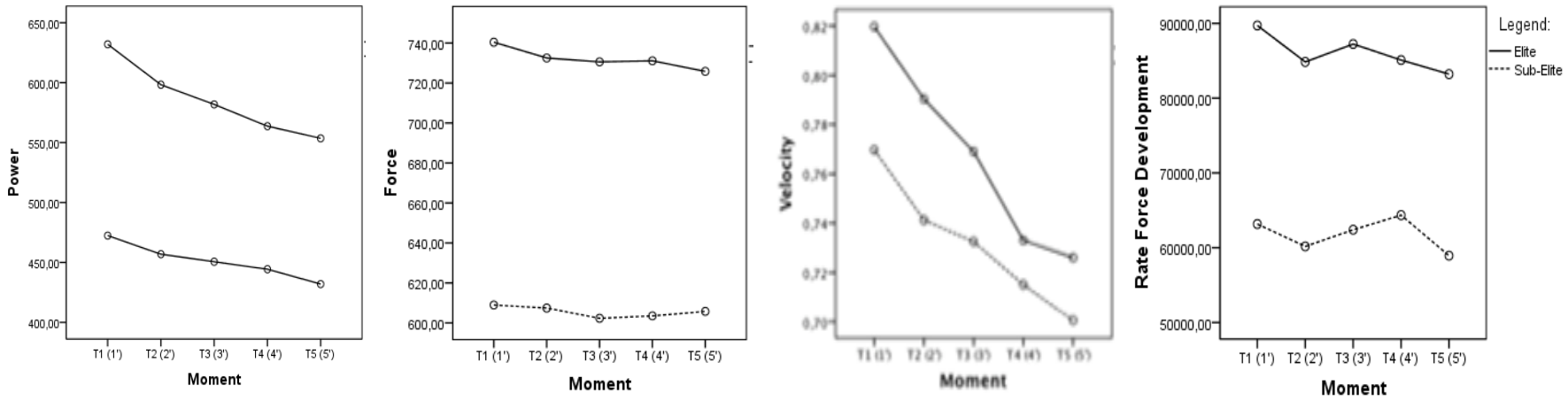

Figure 2. Impact of the COPTEST on power, strength, velocity and RFD of Top-elite and Elite judo athletes.

Discussion

The maximization of the power development capacity must be a key component of judo training programs.

The effect of fatigue on power, strength, velocity, and RFD is independent of the performance group.

The observed slight reduction in power and velocity
(in both, top-elite and elite male groups)
must be investigated
(i.e., changes in the contractile apparatus vs reduced muscle activation).

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