

A Comparison of Isokinetic Leg Flexion and Extension Strength in Elite Adolescent Male Track and Field Athletes

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INTRODUCTION

The characters of muscle could be specific to different kinds of sports events after long-time training, such as sprinters may perform better in power, poor in endurance, and marathonian may have reversed results. The isokinetic peak torque and torque ratio are important parameters to evaluate the athletic performance or to prevent knee injury (Costill, et al, 1968). So the purpose of this study was to investigate the differences among young male sprinters, jumpers and throwers in the two parameters. We hope the results could be benefit to the information for coaches or athletes in muscular training.

METHODS

Three groups of well trained, adolescent male athletes were subjects in this study. One group consisted of 17 short-distance runners (<400m, age:17.8±1.4 yrs, weight:65.3±4.41 kg). Another group consisted of 10 long or high-jumping jumpers (long and high jumping, age:17.5±1.4 yrs, weight:64.0±6.4 kg). The last one consisted of 12 throwers (javelin, shot-put, discus, age:17.4±1.7 yrs, weight:91.7±16.8kg). They were asked to stop training at least one day, and signed informed consent for the information about basic procedures before experiment.

Quadriceps and hamstring were analyzed in this study. The measurement was mainly divided into three portions. First is the peak torque of quadriceps (QUAD PT) during concentric (QUAD con) and eccentric (QUAD ecc) periods. Second is the peak torque of hamstring (HAM PT) during the concentric (HAM con) and eccentric (HAM ecc) periods. The peak torque was maximum torque within certain period in dominant leg and measured by using a Cybex-6000 isokinetic dynamometer. The concentric data were collected at angular velocity of 180°/sec for 4 consecutive contractions, and eccentric ones were at angular velocity of 120°/sec for 4 consecutive contractions. The relative peak values (divided by

body weight) were also analyzed. Last is the ratio of H/Q (HAM PT / QUAD PT) during their concentric period. SPSS one-way ANOVA was used to compare the difference in peak torques of the three groups. The significant value was set at .05, and Scheffe method was used for post-hoc comparisons.

RESULTS AND DISCUSSION

Table 1 and 2 showed that the throwers' absolute peak torques were significantly higher than sprinters' and jumpers' during both types of quadriceps' contractions (P< .05). The hamstrings' absolute values were similar to quadriceps', although without significant difference among the three groups. However, reversed results that the sprinters' and jumpers' relative peak torques were higher than throwers', but without significant difference among them, could be seen during both types of contractions in the two muscles. It indicates that runner and jumper may need faster movement than thrower do, so the influence of body weight should be taken into consideration.

The mean H/Q ratios of sprinters, jumpers and throwers were 0.61, 0.58 and 0.56 respectively, and there was not much difference among the three groups. The values were similar to those observed in young basketball players in Gerodimos et al.

CONCLUSIONS

In healthy adult, the H/Q ratios ranges between 0.56~0.8. If the athlete value lower than those, the training in hamstring should be increased for maintaining muscular balance.

REFERENCES

1. Costill, D. L. et al. *Research Quarterly for Exercise & Sports*, **39**, 780 -785, 1968.
2. Gerodimos, N. et al. *J Sports Medicine & Physical Fitness*, **43(4)**, 444 -452, 2003.

Table 1: The absolute (ABS) and relative (REL) peak torques (PT) of quadriceps in concentric and eccentric contractions.

Type of action Sports Event	Concentric period (knee extension)			Eccentric period (knee flexion)		
	Runner	Jumper	Thrower	Runner	Jumper	Thrower
Abs PT (Nm)	150.9 ± 21.3*	152.4 ± 32.4+	203.8 ± 36.9*+	176.7 ± 39.8*	197.8 ± 50.5	228.2 ± 43.1*
REL PT (Nm/kg)	2.0 ± 0.2	2.3 ± 0.5	2.2 ± 0.2	2.7 ± 0.7	3.1 ± 0.6	2.6 ± 0.6

Table 2: The absolute (ABS) and relative (REL) peak torques (PT) of hamstring in concentric and eccentric contractions.

Type of action Sports Event	Concentric period (knee flexion)			Eccentric period (knee extension)		
	Runner	Jumper	Thrower	Runner	Jumper	Thrower
Abs PT (Nm)	91.2 ± 11.4	86.6 ± 14.3	114.1 ± 21.7	98.2 ± 22.1	114.9 ± 30.8	140.6 ± 22.2
REL PT (Nm/kg)	1.4 ± 0.1	1.3 ± 0.1	1.2 ± 0.2	1.5 ± 0.3	1.8 ± 0.4	1.6 ± 0.3

* and + : P < .05