RELATIONS BETWEEN STRENGTH QUALITIES AND KINEMATICS OF DISTINCT PHASES OF A SPRINT RACE

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INTRODUCTION

The importance of strength for sprint performance is many times questioned as there are conflicting results regarding the correlation between isokinetic-isometric torque and sprinting time [1, 2]. However, maximum torque is not the only variable denoting strength and moreover time is just the output of a runner's potential. The aim of the study was to examine the relationship between parameters of isokinetic-isometric strength and kinematics of distinct phases of a competitive sprint race (100m.).

METHODS

Thirty-one sprinters (17 male and 14 female, 21.7±3.3 yrs) were filmed (125 Hz) performing a maximum 100m sprint (M: 11.4±0.4, F: 13.1±0.6). Kinematic variables (Vx, Vy: horizontal and vertical velocity during push-off, CMy: position of centre of mass during start, CT: contact time, FT: flight time, SL: stride length, FL: flight length) were collected by 2 high frequency cameras (Redlake, 125 Hz) in distinct phases of the race: start, acceleration, maximum speed and deceleration phase. The subjects also performed knee Extension/Flexion (30˚/s-240˚/s), knee isometric Extension (30˚-60˚), ankle Plantar/Dorsal flexion (30˚/s-180˚/s) and ankle isometric plantar flexion (0˚-20˚) (CybexII+). Correlation coefficients were calculated between strength parameters and kinematic variables.

RESULTS AND DISCUSSION

Significant correlation coefficients between strength parameters and kinematic variables are presented in table 1.

It can be remarked that there is a specificity of some variables to some kinematic parameters observed in the distinct phases in terms of muscle type, testing velocity, testing angle and biomechanical functioning [3]. Strength of the knee Extensors/Flexors seems to be crucial mainly in the starting and deceleration phase, while ankle plantar/dorsal flexors are important when the sprinter tries to maintain maximum speed. During the start, the different technique selected by male and female sprinters is depicted as significant correlations exist between different parameters for each gender.

CONCLUSIONS

Muscle strength should not be directly correlated to performance while performance is not a single parameter but the final outcome of various components of human potential. Furthermore, testing conditions and examined parameters should be carefully selected in order to interpret the qualities that need to be evaluated satisfying performance specificity.

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REFERENCES

1. Cronin JB, & Hansen KT, *J Strength Cond Res*, **19:** 349-357, 2005.
2. Dowson MN, et al., *J Sports Sci.* **16**:257-265, 1998.
3. Kukolj M, et al.,. *J Sports Med Phys Fitness*, **39:** 120-122, 1999.

Table 1: Correlation coefficients between strength parameters and kinematic variables (M: Male, F: Female, *p<.05, **p<.01).

			Start			Acceleration Phase			Maximum Speed		Deceleration Phase	
			Vx	Vy	CM Y	CT	FT	FL	CT	FT	SL	FL
Knee	Isokinetic	30°/s E						F-.544*				
		30°/s E/F						F.634*				
		240°/s E		F.634*					M-.498*		M.675**	
		240°/s F		F.606*								
		240/30°/s E					F.606*	F.538*				
	Isometric	30° Pmax		F.578*							M.750**	M.583*
		30° RFD_{300ms}		F.668**	M.505*						M.565*	
		60° Tmax	M.509*								M.807**	M.641**
		60° RFD_{300ms}										M.545*
Ankle	Isokinetic	30°/s PF	M.656**		M.673**				M-.652**			
		30°/s DF		M.602*	M.776**				M-.639**			
		180°/s PF	M.631**		M.687**				M-.510*			
		180°/s DF			M.606*							
		180°/s DF/PF				M.670**						
	Isometric	0° Tmax	F.667**									
		0° RFD_{300ms}	F.541*						M-.792**			
		20° RFD_{400ms}								M.643**		