THE DIFFERENT INFLUENCE OF LEG EXTENSOR'S IN DEVELOPMENT PEAK OF FORCE IN DROP JUMP

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INTRODUCTION

Although great number of researches has done to pointing the role of Peak Force (PF) and Rate of Force Development (RFD) in jumping, sprinting and other dynamic sports activity, their role in drop jump performance was not investigated. Young et al [4] investigated relationships between the strength qualities of the leg extensor muscles and performance in vertical jumps performed from a standing position (double leg takeoff) and a run-up (single leg takeoff). They were reported that speed strength tests correlated significantly with both jump types, but maximum strength did not. A few experiments determine the best dropping height and find the best method for drop jump with small angular displacement of the knee from 0.3m [5]. Stone et al [3] investigated relationships between power output in countermovement jump and squat jump at different load conditions, among stronger and weaker subjects. They were reported that stronger subjects have had greater power output at greater load conditions and concluded that maximal strength development is primary factor in jumping ability enhancement [2]. In the presence of different reports, to distinguish the influence of maximal strength and speed-strength in jumping abilities, role of leg extensor's peak force (PF), rate of force development (RFD), rate of force development normalized with peak force (RFD/PF) and time interval from generating 30% to 70% of peak force (T30-70%) in counter drop jump (CDJ) and bounce drop jump (BDJ) performance were tested [1]. RFD/PF and T30-70% represented rate at which force were produced independently of peak force.

METHODS

Forty six male students of physical education, 23±1.9 years of age, 180.8±5.8 cm of height and 77.8±6.7 kg of weight, took part in a study. Isometric PF, (isometric) RFD, RFD/PF and T30-70% for hip and knee extensors, as well as foot plantar flexors, were measured with a strain-gauge dynamometer (Hottinger Baldwin Messtechnik, Germany; 0-5000N; 50Hz). Better of two attempts for every measured muscle groups were analyzed. Subjects also performed two CDJ and BDJ from height of 0.2, 0.3, 0.4, 0.5, 0.6 and 0.7 m. Jumps data: counter -bounce drop jump height and time (CDJH, BDJH, CDJT, and BDJT) presented in (Table 1). Count-bounce drop jump power output (CDJP BDJP), were collected using Ergo-Jump contact mat - Bosco's test system. Better CDJ and BDJ from every height vere analyzed. Dynamometry data were compared with CDJH and BDJP, using Pearson's product – moment correlation.

RESULTS AND DISCUSSION

With dynamometry data, PF for all muscles groups correlated significantly with RFD ($p<0.001$). Correlations between RFD/PF and T30-70% were the strongest ($p<0.001$), we found significantly correlation also, between CDJH and BDJP ($p<0.001$). PF and RFD of measured muscles groups, correlated significantly with CDJH and BDJP, but RFD/PF and T30-70%, did not. Since RFD depend upon amount of produced force (i.e. peak force) and rate at which force were produced, it is not known whether the peak force produced by muscles or rate at which they were generated force, had greater influence on RFD. For the hip extensors, correlations with RFD were stronger in CDJ from lower heights, only. Bounce drop jump power output (BDJP) showed stronger correlations with RFD of knee extensors in jumps from lower heights. Factor analysis showed that peak force factors for all measured leg extensor muscles, have had greater overall influence on drop jump performance, even if their influence on RFD variability were lower. It was concluded that peak force factors have a greater role in CDJ and BDJ performance, regardless of stronger correlations between BDJP and RFD of knee extensors, as well as between CDJH and RFD of knee and hip extensors in some jumps.

CONCLUSIONS

From a practical approach, to improve impact jumping ability, depending upon stretch shortening cycle, these results suggests that improving a maximum strength, rather than speed strength, should be a primary component of training programs.

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Table 1: Jumps data: Counter drop jump height (CDJH) and time (CDJT) - Bounce drop jump height (BDJH) and time (BDJT).

	Height (m)					
	0.20	**0.30**	**0.40**	**0.50**	**0.60**	**0.70**
CDJH (m)	0.32 ± 0.056	0.34 ± 0.053	0.35 ± 0.061	0.36 ± 0.057	0.35 ± 0.058	0.34 ± 0.064
BDJH (m)	0.28 ± 0.054	0.31 ± 0.057	0.31 ± 0.058	0.32 ± 0.062	0.32 ± 0.062	0.31 ± 0.070
CDJT (ms)	230.0 ± 40.3	217.6 ± 35.9	222.9 ± 41.3	226.8 ± 35.9	220.4 ± 42.7	236.6 ± 43.9
BDJT (ms)	144.1 ± 28.3	141.9 ± 22.4	148.5 ± 26.0	151.1 ± 27.3	149.6 ± 25.7	155.7 ± 26.0