

IS PASSIVE PLANTAR FLEXION TORQUE DETERMINANT OF LOWER LIMB STIFFNESS?

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INTRODUCTION: It has been supposed that leg stiffness affect repeated jump performance, such as hopping. Previous study indicated that ankle joint stiffness is important in leg stiffness (Arampatzis et al. 2001). Furthermore, it was demonstrated that Achilles tendon properties could contribute to the total mechanical work during hopping (Lichtwark and Wilson 2005). On the other hand, it is known that passive plantar flexion torque (PT) is determined by tendon properties (Kawakami et al. 2008). However, no study has been focused on the effect of PT on leg stiffness in hopping. The purpose of this study was to investigate the relationship between passive plantar flexion torque and leg stiffness.

METHODS: Ten female students participated as subjects and gave written informed consent prior to the study. They seated with the right knee extended and ankle positioned at every ten degrees from +30 degrees to -30 degrees (0 degrees; neutral position), and PT was measured simultaneously. Furthermore, they performed in-place hopping, matching metronome beats at 3.0 and 1.5Hz on a force platform. During hopping, subjects were filmed from the right side in sagittal plane with high-speed video camera at a sampling frequency of 300Hz. Leg stiffness was calculated as the change in ground reaction force divided by the vertical change in the center of mass during contact.

RESULTS: Table 1 represented physical characteristics, PT and leg stiffness. PT had no significant correlation with leg stiffness at 1.5Hz ($p > 0.05$), though significant correlation was found with leg stiffness at 3.0 Hz ($r=0.787$, $p<0.01$, Fig.2).

Table 1 physical characteristics, PT and leg stiffness

		mean \pm SD
Hight (m)		1.63 \pm 0.07
Weight (kg)		59.2 \pm 9.0
Age (yrs.)		20.5 \pm 0.8
Passive TQ (Nm)		7.1 \pm 1.3
Leg Stiffness (kN/m)	1.5Hz	0.41 \pm 0.12
	3.0Hz	0.84 \pm 0.16

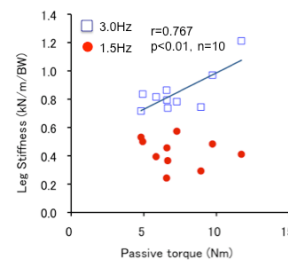


Fig.1 Relationship PT and leg stiffness

DISCUSSION: PT was significantly correlated with leg stiffness on faster counter movement. PT might have influenced the leg stiffness in hopping because it was related to the elasticity of Achilles tendon (Kawakami et al. 2008). If the contribution of the Achilles tendon increases along with the speed of the movement, this results suggest that PT may affect leg stiffness in hopping.

CONCLUSION: PT affected leg stiffness on fast repeated jump performance.

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