Leg stiffness during hopping does not change with aging

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H. HOBARA, Y. KOBAYASHI, M. MOCHIMARU. ***Leg stiffness during hopping does not change with aging.*** *Gerontechnology 2014;13(2):205;* doi:10.4017/gt.2014.13.02.251.00 **Purpose** During hopping, jumping and running, the musculoskeletal structure of the legs is often modelled with a spring-mass model, which consists of a body mass and a linear leg spring supporting the body mass[1]. In the model, the stiffness of the leg spring (leg stiffness; K_{leg}) is thought to be an important factor in musculoskeletal performance[2]. However, despite the fact that many athlete's activities are often measured, little is known about the regulation of K_{leg} in the elderly. Therefore, the purpose of the present study was to compare the K_{leg} between the elderly and young subjects in a range of hopping frequency. **Method** Fourteen elderly and eleven young subjects performed in-place hopping, matching metronome beats at 2.2, 2.6 and 3.0Hz. Based on the spring-mass model, K_{leg} was calculated as the ratio of maximum ground reaction force to maximum center of mass displacement at the midstance (*Figure 1*). **Results & Discussion** In both groups, the K_{leg} increased with an increase in hopping frequency, but was not significantly different between groups (*Figure 2*). Statistical analysis revealed the existence of a significant main effect of hopping frequency on K_{leg}. However, main effect of groups and interaction on K_{leg} were not observed. The results of the present study indicate that leg stiffness during hopping is invariant with aging. Since too high or too low K_{leg} is associated with musculoskeletal injury[2], footwear and/or surface materials, impact on K_{leg}[2] should be considered for athletic environment in both master and young athletes.

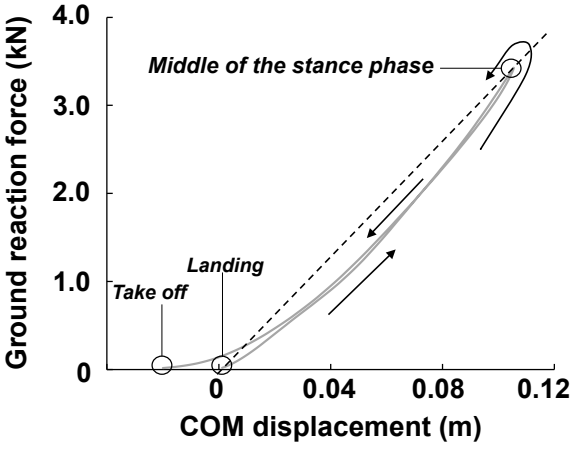

Figure 1. Force-COM displacement curve for the elderly at 2.2Hz recorded from one subject; The leg was compressed from the instant of landing, and vertical ground reaction force increased; The force peaked at mid stance, and subsequently decreased with extension of the leg until take-off; The slopes (dotted lines) of these curves represent K_{leg}.

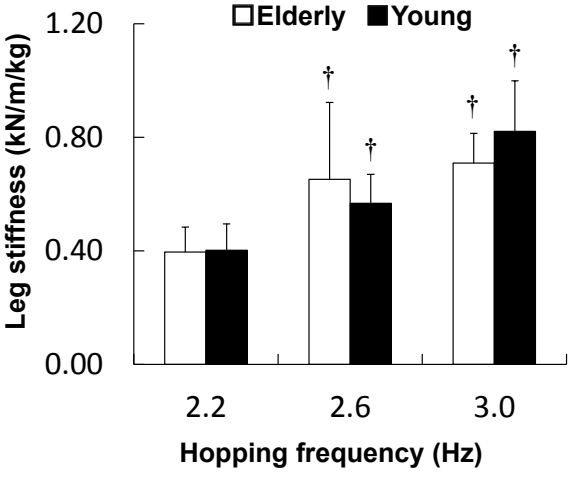

Figure 2. J Comparisons of leg stiffness between the elderly and young subjects in three hopping frequencies; A dagger (†) indicates significant differences between adjacent frequencies at p<0.01

References

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