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MAXIMUM FUCTIONAL STRENGTH THE KNEE AND ANKLE OF YOUNG AND ELDERLY

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INTRODUCTION

Age-related strength loss in lower limbs has clinical implication because it may reduce the ability of older adults toper form daily activities independently and safely [1]. Also, age-related weakness may predispose older adults to perform sub maximal daily activities in a higher sense of effort, which may cause fatigue and increase the risk of falls [2]. According to Wert et al. (2010) the functional maximum force, which is a biomechanical variable related to the capacity of generate dynamic force, may evidence the ability of older adults to recovery the balance after tripping [3]. Thus, this study aimed to compare the knee and ankle functional maximal force of older and younger female adults.

METHODS

Subjects

Data of nineteen younger (21.83 yr.) and twenty one older (66.05 yr.) female adults were considered for this study. Both groups had similar mass (61.43 kg for younger adults and 63.20 kg for older women) and younger adults had significant higher height ($p < 0.001$). Table 1 shows participant's characteristics.

Procedures

Strength measurements of knee and ankle (sagittal plane) were recorded by an isokinetic dynamometer (Biodex, New York, USA). Before strength assessment the volunteers performed a warm up of five minutes walking on the treadmill at self-selected pace. Three maximal isometric voluntary contractions (MIVC) were performed for duration of five seconds, with 30 seconds of rest between each trial. Also, five maximal isokinetic contractions (60º/s) were performed. The order of the trials were randomized and strong verbal encouragement to obtain maximal effort was provided. Before the data collection, a habituation section was performed using the same procedures of the data collection protocol.

Data analysis

Maximum isometric and isokinetic torque were normalized by subject's body mass ($Nm \cdot kg^{-1}$). Then, the isokinetic maximum torque was divided by the maximum isometric torque to obtain the functional maximal strength [4] of each joint separately (knee and ankle).
Test-t for independent samples were used to compare the strength measures (isokinetic peak torque, isometric peak torque and functional maximal force).The significance level was set at $p < 0.05$ for all tests.

RESULTS AND DISCUSSION

Younger female adults were stronger than older female adults for all isometric and isokinetic torque measures. Knee flexor isometric and isokinetic torque were 47% higher in younger adults ($p < 0.001$, for both); knee extensor isometric and isokinetic toque were 41 and 46.8% higher in younger adults ($p < 0.001$, for both); ankle flexor isometric and isokinetic torque were 12.8 and 27.2% higher in younger adults ($p = 0.04$ and $p = 0.005$, respectively); and ankle extensor isometric and isokinetic torque were 39.3 and 43.4% higher in younger adults ($p < 0.001$). Knee extensor and ankle flexor maximal functional strength was, respectively, 12.8 and 25% lower in older adults ($p = 0.005$). Figure 1 shows these results.

Maximal functional strength reflects the ability to generate torque in dynamic contractions. Thus, the reduced maximal functional strength in older adults may increase the risk of falls because it may impair the ability to recovery the balance after tripping [5].

Age-related weakness can be caused by impaired intrinsic force generate capacity and abnormalities in muscle fiber contractile, metabolic properties, excitation-contraction coupling and muscles activation pattern. Also, age-related strength loss can affects the biomechanical gait pattern. According to Marques et al (2013) lower isokinetic strength of knee extensors is associated with higher activation of rectus femoris at stance phase in older female fallers [6].

With respect four results, the decreased knee and ankle strength in older adults must be factors that increase the risk of falls and impaired mobility in older adults. In particular, the reduction of knee extensors and ankle flexors maximal functional strength must be an important parameter in the assessment of mobility and risk of falls in older adults.

CONCLUSIONS

With respect of this, the authors also suggested that lower knee extensor strength may reduce the knee stability during the gait and higher activation of rectus femoris may contribute to higher sense of effort and fatigue, which increase the risk of falls.

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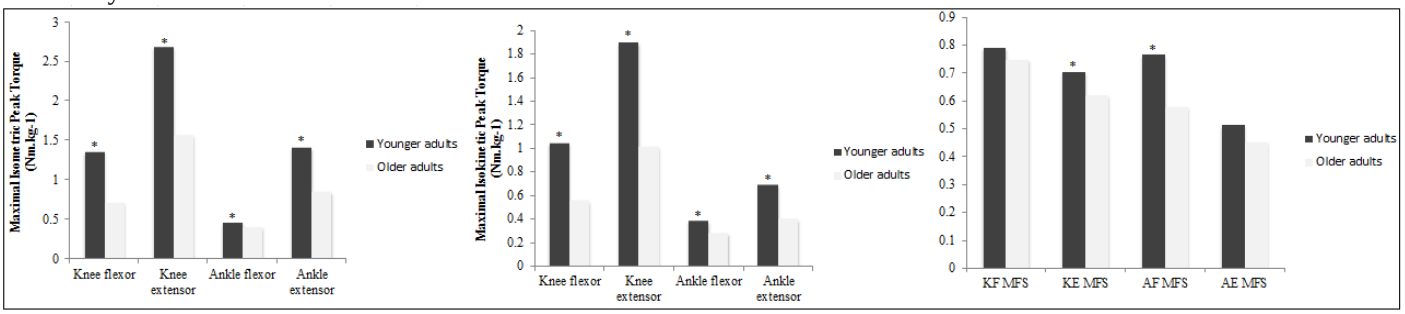
Figure 1: Values for Functional Maximum Strength, Isometric Torque and Isokinetic Torque knee joint and ankle of young and elderly.



* p<0,05. Significant difference between young and elderly.

Table 1: Subject descriptive characteristics.

	Younger	**Elderly**	**P**
Age (year)	21.83(±2,18)	66.05(±6,39)	< 0.001*
Height (m)	1.62(±0,05)	1,55(±0,06)	< 0.001*
Mass (Kg)	61.43(±7,51)	63.20(±12,39)	0.601
Body Mass Index(Kg/m^2)	23.35(±3.39)	25.32(±3.37)	0.09

* p<0,05. Significant difference between young and elderly.