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Comparing Intrinsic Foot Muscle Strength and Dynamic Balance in Older Active Males
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Introduction
The Foot:
- provides the base of support for the body and plays essential roles in walking, jumping, running, and many other functional activities.
- plays a major role in balance
- includes 10 muscles known as intrinsic foot muscles (IFM) which assist in the control of pronation and supination at the subtalar joint

IFM Strength
- IFM weakness is associated with increased foot pain (Latey, 2017)
- IFM weakness has been associated with increased fall risk in the elderly due to their role in stabilization and balance (Bruening, 2019)
- IFM become weaker with age (Mickle, 2016)

Balance
- is especially important amongst elderly populations, since injury associated with falls results in major decrease in quality of life.
- 35%-45% of community dwelling adults (ages 65+) report a fall every year (Soriano, 2007)
- Falls have been related to both foot pain and decreased foot strength (Menz, 2018)

Purpose: To examine the relationship between IFM strength and dynamic balance in healthy, active older adults.

Subjects
- 50 male participants of the Huntsman World Senior Games
- 50-59: n=6, 60-69: n=25, 70-79: n=16, 80-85: n=3
- Age: 67.5 ± 7.5 years
- Height 177.6 ± 8.32 cm
- Weight 84.4 ± 14.9 kg
- Active based on Rapid Assessment of Physical Activity questionnaire

Analysis: Completed using custom analysis software. From a graph, we determined the highest force exerted by the toes excluding any extreme peaks. Once data were collected for all trials, we averaged the three trials prior to statistical analysis.

Measurements – Dynamic Balance

Modified Star Excursion Balance Test
- Maximum reach was measured in anterior, posterior medial, and posterior lateral directions.
- Subjects performed 3 trials in each direction. Averages of these trials were used to calculate a composite reach score.

Measurements – Muscle Strength

Doming:
- Foot was placed in a Brannock device with a cuff placed over the dorsal foot. Cuff was attached to the dynamometer. Subjects performed doming to maximal plateau for 3 seconds and then released.

Big toe flexion:
- A carabiner was attached to the dynamometer. Boards were placed under the feet to support from the heel to the base of the toes. Subjects pulled to maximal plateau for a count of 3 and then released.

Lateral toes flexion:
- A metal bar was attached to the dynamometer and gripped between the 2nd and 3rd toes. Subjects pulled to maximal plateau for 3 seconds and then released.

Results

Discussion and Conclusions
- Dynamic balance results did not show any significant correlation with foot strength.
- Correlation data, plotted in different colors by age groups, shows that there is no correlation, regardless of age.
- These findings highlight the fact that dynamic balance is not solely dependent on IFM strength. Other factors such as flexibility or joint stability may need to be assessed in the future.
- Foot strength and dynamic balance are expected to decrease with age, however our data did not match this pattern (IFM strength was low among 50-59 group; balance increased for 80-85 group).
- Limited sample size in these two groups may contribute to this variability.

References