INTRODUCTION
Muscle performance depends on the geometrical arrangement of fascicles and contribution of connective tissue both external and internal to the muscle belly. During concentric contractions the muscle belly shortens, the pennation angle increases and the belly thickness changes as a muscle produces force and power. As we age, the muscle structural parameters change [1] and this may contribute to the reduction in strength and consequent loss of mobility and quality of life. Thus, the primary goal of this study was to perform a detailed muscle structural (fascicle length, pennation angle, belly thickness and belly gearing) and functional (ankle torque and power) comparison between young adults and seniors to determine the differences in muscle structure and links to possible causes of deterioration in performance with ageing. The ankle plantarflexors, Medial Gastrocnemius (MG) and Lateral Gastrocnemius (LG) were tested for this study as these performed differently from each other.

METHODS
The two plantarflexors were tested using ultrasound (Echoblaster, 128 EXT-1Z, Telemed) from 10 young adults (20-40 years) and 10 seniors (70-85 years) while they performed an isovelocity movement on a dynamometer (System 3, Biodex). Participants performed maximal plantarflexion at four constant velocities (150, 120, 90 and 45° sec⁻¹) and torque, position and time were recorded. Muscle belly was imaged using ultrasound during the contractions. The passive muscle structures were also imaged during standing. Ultrasound images were later digitized and the structural parameters determined. The changes in fascicle lengths, pennation angle and belly thickness during contraction were calculated, and the muscle gearing was taken as the ratio of the belly shortening velocity to the fascicle shortening velocity. The effect of the measured kinematic parameters from the dynamometer on the muscle parameters was determined using GLM ANCOVA. Participant was a random factor and maximum angular velocity was a covariate. Effects were considered significant at a level of $\alpha = 0.05$. All results are presented as mean + s.e.m.

RESULTS
During standing, the muscle belly thickness in seniors was significantly lower than young adults. During plantarflexion contractions of the MG and LG, the muscle tendon unit length and belly length decreased. Within the muscle bellies, the fascicles shortened and increased in pennation angle. The rotation of the fascicles (change in pennation), belly gearing and ankle torque were all significantly lower in seniors (Figure 1B, C, D).

DISCUSSION & CONCLUSIONS
Muscle atrophies during ageing in a process known as sarcopenia. This leads to reduction in muscle size, strength and power [2, 3] limiting the functional performance. Atrophy can be seen here by the significant reduction in MG and LG belly thickness in seniors (Figure 1A). As the individual muscle fibres atrophy and decrease in diameter, a reduction in the pennation angle would be expected and this was the case for both MG and LG. Increased pennation is commonly associated with increased rotations of the fascicles during contraction which cause an increased gearing [4]. In this study, the reduced fascicle rotations in the muscles of seniors resulted in the reduced belly gearing (Figure 1B, C). Reduced gearing results in the muscle fibres shortening faster and with lower force producing potential for a given movement [4]. Thus, it is possible that the seniors experience a decrease in performance associated with reduced gearing due to atrophy of the muscles.

REFERENCES