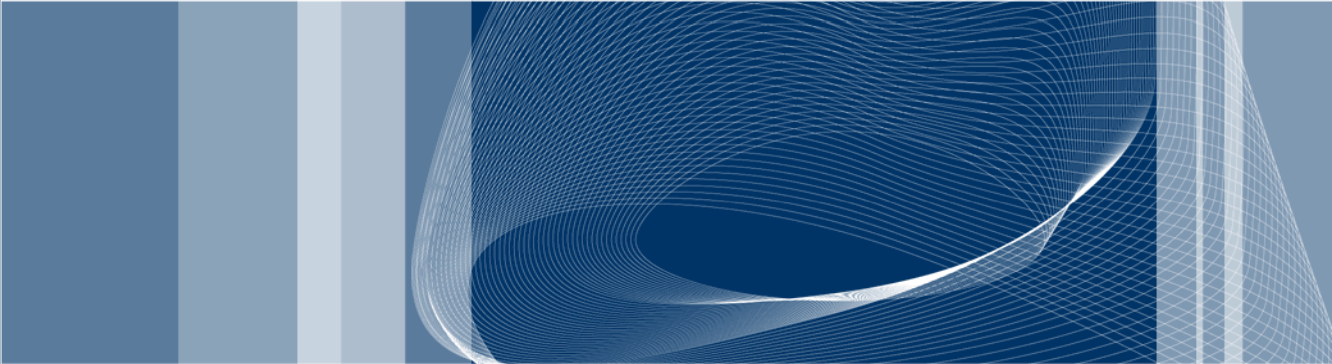




Consiglio Nazionale delle Ricerche
Istituto di Bioimmagini e Fisiologia Molecolare

 POLITECNICO DI MILANO



Segmentation of CT images to evaluate the effect of gender, age and body adiposity on lower limbs muscle characteristics

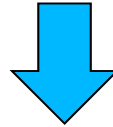
Daniele Tresoldi

Skeletal muscle structural features are allegedly related to functional properties and recognised as main determinants of work capacity and physical performance involved in human locomotion, as well as in basic daily activities contributing to a good quality of life

Muscle characteristics are deeply affected by common conditions like obesity and ageing

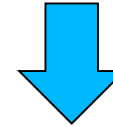


Skeletal muscle characterization



quantitative

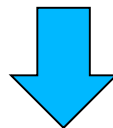
- mass
- CSA (cross-sectional area)



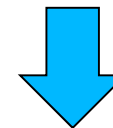
qualitative

- composition
- regional tissue distribution

CT Imaging technique can provide a direct measurement of muscle tissue



Volume [l]



Attenuation [HU]

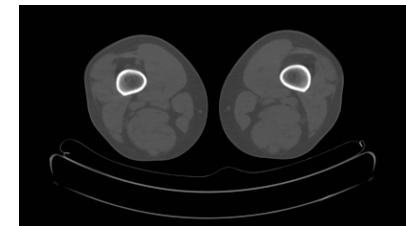
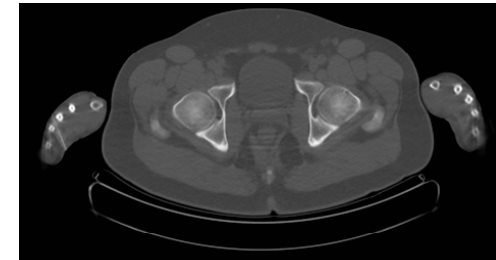
related to adipose infiltration within muscle



To develop a CT-based method
to assess
the lower limb skeletal muscle characteristics
in a sample of men and women
within a wide range of age
and body adiposity

CT acquisition

21 male and 18 female subjects
(age range: 31-76 yrs., BMI range: 19-36 kg/m²)
acquired in supine position with a voxel size of 1.17x1.17x5 mm³ and no gap between slice



Pre-processing

crop from the most cranial border of the iliac crest to the latera malleolus

saturation pixels < 0 HU set to 0
pixels > 300 HU set to 800

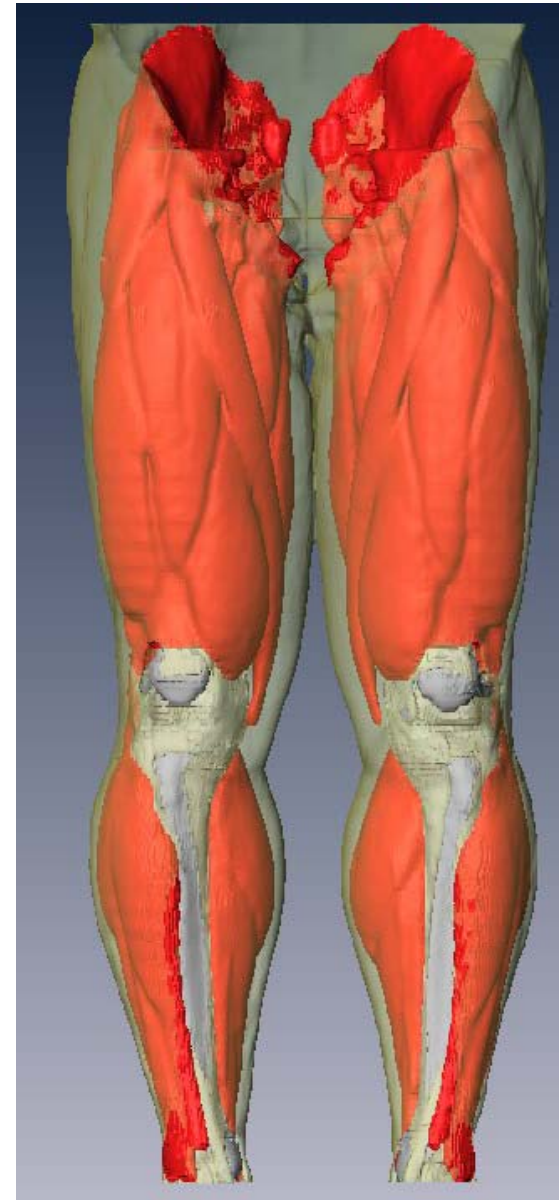


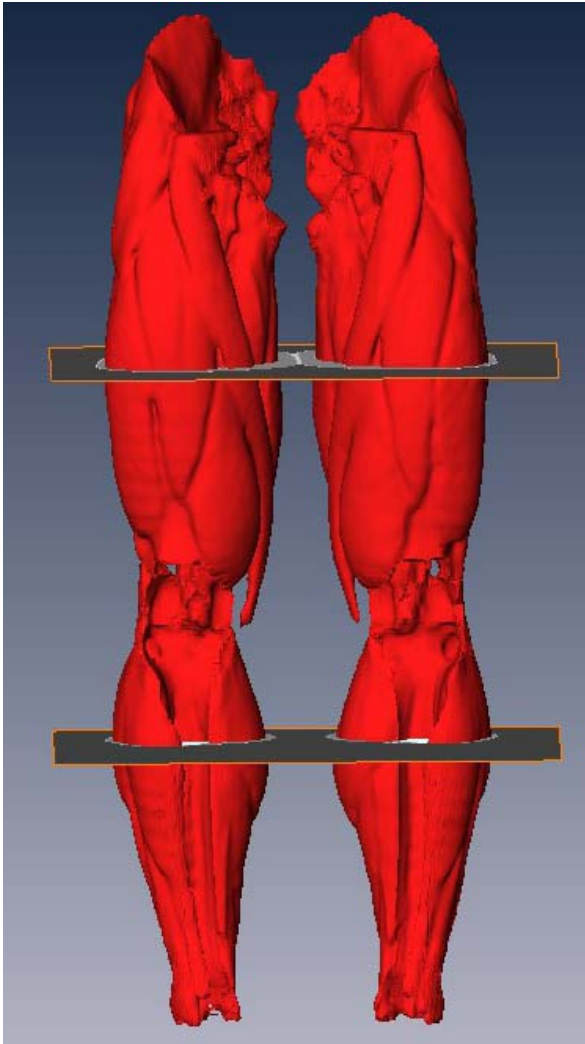
Segmentation

Bone removal: region growing algorithm controlled by the operator

Muscle and Adipose Tissue identification: fuzzy c-means algorithm with 3 clusters

Clusters centroids: 0 HU → background
170 HU → adipose tissue
320 HU → skeletal muscle

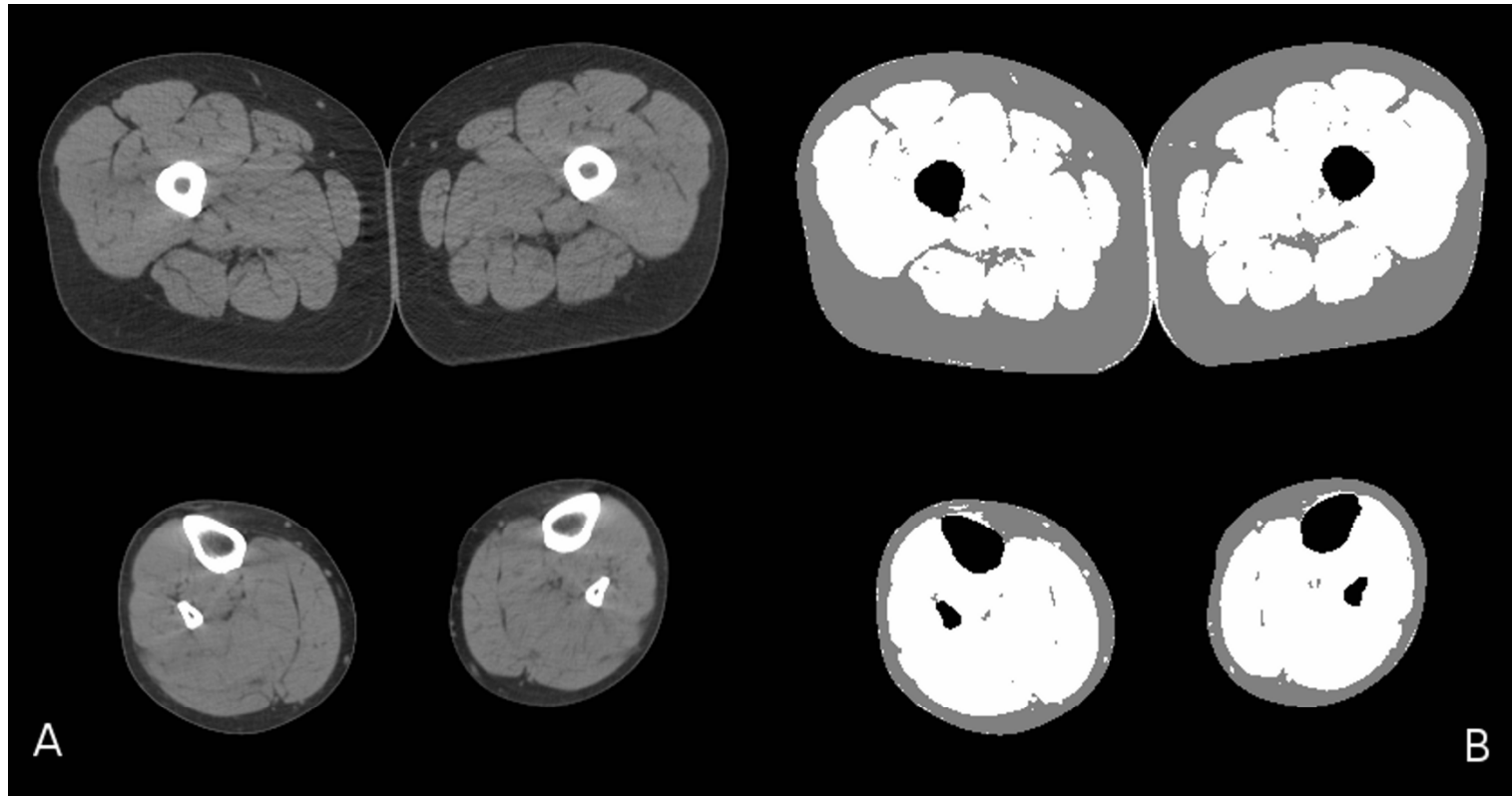




Evaluation of Muscle Attenuation

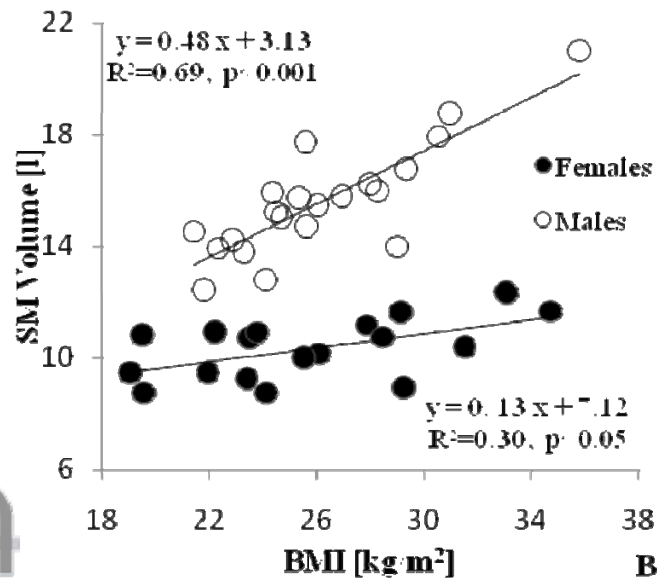
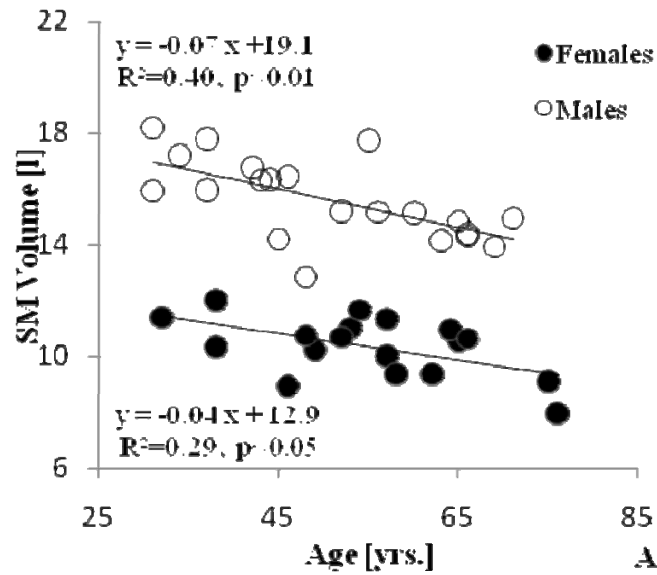
- midhigh
- at 1/3 of the leg

- Identification of the muscle shape of dominant leg in the 2 positions and creation of 2 binary mask
- Masks erosion (circular structural element, $r=3$)
- Mean of the value in the acquired volume identify by the masks



Acquired images

Segmented images



Muscle volume:

➤ is significantly higher in men (15.63 • 2.11 l) than in women (10.34 • 1.21 l)

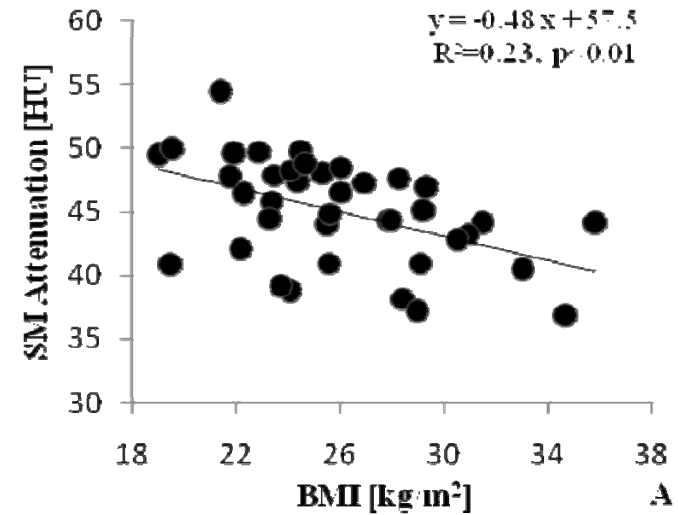
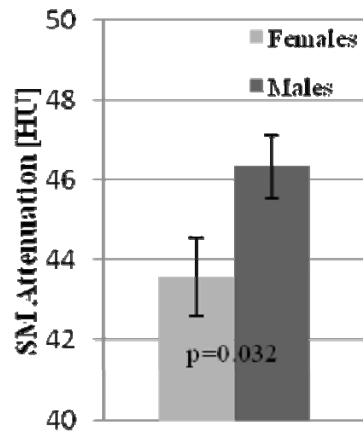
➤ decrease significantly as a function of age

➤ increase as function of BMI (body mass index)



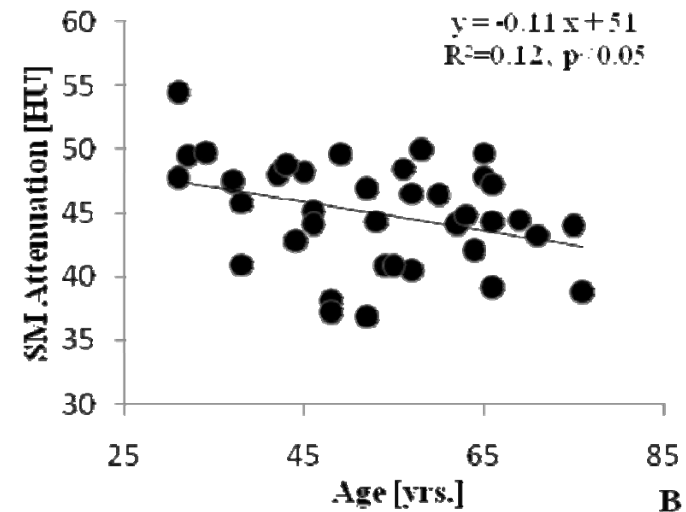
Results III

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Skeletal muscle attenuation coefficient:

- is significantly higher in man than in women
- decreased significantly as a function of BMI and age



- The fuzzy c-means method is fast and operator-free but a preliminary semi-automatic preprocessing step is necessary
- The results are in agreement with those obtained with different (less accurate or operator dependent) methods
- This findings investigate the effect of body adiposity/obesity on skeletal muscles volume (quantity) and attenuation (quality) which are both correlated with motor function

Improvment:

- Developing an automatic (3D) method to segment bone
- Validating the method



***Thanks for
you
attention!!!***

