

Table 1. Short descriptions of the shape descriptors from Ward et al.²¹, extracted for each individual muscle

Descriptor	Description	Extreme Values -	Extreme Values +
Volume (cm ³)	Enclosed 3D shape volume.	Smaller object	Larger object
Normalized volume	Volume divided by body mass index (BMI).	Smaller volume for BMI	Larger volume for BMI
Relative volume (%)	Individual muscle volume relative to total muscles volume.	Smaller proportion of total volume	Larger proportion of total volume
Eigenvalue ratio λ_1/λ_2	Ratio of variances along primary and secondary directions, representing elongation.	More spherical shape (ratio approaches 1)	More cylindrical or elongated shape (ratio > 1)
Eigenvalue ratio λ_1/λ_3	Ratio of variance along primary to tertiary axis.	More uniform shape (ratio closer to 1)	High elongation along major axis (ratio » 1)
Eigenvalue ratio λ_2/λ_3	Ratio of variance along secondary to tertiary axis, indicates disk vs. cylinder shape.	Cylindrical shape (ratio approaches 1)	Disk-like shape (ratio » 1)
Centroid Distance (cm)	Average Euclidean distance from all surface points to the centroid, measure of size.	Smaller size	Larger size
Centroid Distance Std (cm)	Standard deviation of distances from surface points to centroid, measure of surface roughness or non-sphericity.	More regular surface or more spherical	More irregular surface or less spherical
3D moment J_1	First moment invariant, invariant to translation and rotation, captures spatial distribution characteristics.	Smaller distribution of mass	Greater distribution of mass
3D moment J_2	Second moment invariant, invariant to translation and rotation, captures spatial distribution characteristics.	More balanced mass distribution	More complex mass distribution
3D moment J_3	Third moment invariant, invariant to translation and rotation, captures spatial distribution characteristics.	Simpler spatial characteristics	More complex spatial characteristics
Surface area (cm ²)	Total area of the 3D muscle surface.	Smaller surface	Larger surface
Surface area/volume (1/cm)	Ratio of surface area to volume, captures aspects of both shape non-sphericity and size.	More spherical shape (approaches minimum for spheres)	Less spherical, potentially more folded surface