Estimation of reduction in collagen content per mg tissue caused by muscle fiber growth induced by postdevelopmental myostatin knockout

It is assumed that increase in muscle mass after myostatin depletion is caused by hypertrophy of individual fibers rather than addition of new fibers. This assumption is supported by our analysis of >1,000 fibers from quadriceps of male mice with postdevelopmental myostatin knockout and >1,000 fibers from quadriceps of male mice with normal myostatin expression. The mean increase in fiber diameter was 29%, which was close to the mean percent increase in quadriceps mass.

If fiber cross sectional area (CSA) increased to the same extent as muscle mass, then CSA increased 26% (average of gastrocnemius and quadriceps). Because CSA is proportional to the square of the fiber diameter,

Relative increase in diameter = [relative increase in CSA]$^{0.5}$.

Relative increase in diameter = $[1.26]^{0.5}$ = 1.122

Because fiber circumference is directly proportional to diameter, the relative increase in circumference also was 1.122.

The percent reduction in circumference is 100% – (100 x [1/1.122])% = 11%.

If each fiber is surrounded by the same thickness of extracellular matrix (ECM), and if the amount of collagen per volume of ECM does not change, then it follows that the amount of collagen per unit volume of muscle also should decrease 11% if the average size of muscle fibers increases 26%.