

## Correlation between Mid-thigh Low Density Muscle and Insulin Resistance in Obesity

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**Background and Aims:** The inverse relationship between abdominal visceral adiposity and insulin sensitivity has been well recognized in previous studies. Recently, novel issues regarding an unexpected role of intramuscular triglyceride content in the pathogenesis of insulin resistance are emerging. We investigated the potential link between lipid-rich skeletal muscle, namely low density muscle, and insulin resistance.

**Design:** 5 lean and 33 obese subjects (M:F = 12:26, mean age  $42.4 \pm 12.9$ ) without systemic illness were involved in our cross-sectional study. The abdominal and mid-thigh adipose tissue areas and muscle area were measured by using computed tomography. The mid-thigh skeletal muscle was subdivided into two areas, namely low density muscle (Hounsfield Number :  $+0 \sim +30$ ) and normal density muscle (Hounsfield Number :  $+31 \sim +100$ ), according to muscle attenuation. The HOMA (Homeostasis Model Assessment) score was calculated to assess whole-body insulin sensitivity.

**Results:** The mean values of body weight and BMI were  $75.8 (\pm 11.5)$  kg and  $28.5 (\pm 3.87)$  kg/m<sup>2</sup>, respectively.

The mean value of HOMA score was  $2.08 (\pm 1.99)$ . The mean value of abdominal visceral fat area was  $104.25 (\pm 42.77)$  and the mean mid-thigh muscle

areas were  $106.27 (\pm 22.88) \text{ cm}^2$  for normal density muscle and  $16.90 (\pm 6.41) \text{ cm}^2$  for low density muscle. In comparison with linear correlation between BMI and abdominal visceral fat area, the mean value of low density muscle area showed a significant rise in the grade II obesity group. Among several variables, the mid-thigh low density muscle area revealed the strongest correlation with the HOMA score ( $r=0.455$ ,  $p=0.004$ ) and consistent results on the regression analysis (standard coefficient  $=0.445$ ,  $p=0.006$ ). Even after adjusting for total body fat or abdominal visceral fat, the correlation between low density muscle area and insulin resistance was not affected ( $r=0.5123$ ,  $p=0.001$  and  $r=0.4446$ ,  $p=0.006$ , respectively).

Conclusion : Although the low density muscle area holds relatively small portion of the total thigh area, it appears to be one of the reliable determinants of insulin resistance. Impaired fatty acid metabolism by insulin resistance may lead to abnormal triglyceride accumulation within skeletal muscle and later in turn play a pivotal role in the pathogenesis of insulin resistance, especially in the high grade obesity, later stage of the metabolic syndrome.