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Impact of Different Fat Depots on Insulin Sensitivity: Predominant Role of Liver Fat

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Abstract

Background:
Overall obesity and, as it is increasingly appreciated, body fat distribution and ectopic fat deposition in liver and skeletal muscle, determine insulin resistance in humans. However, little is known about the independence of these relationships. Therefore, we determined the impact of different fat depots as well as fat accumulation in ectopic tissues such as liver and skeletal muscle in the prediction of insulin resistance in healthy humans.

Methods:
Visceral and subcutaneous abdominal fat were determined by magnetic resonance (MR) tomography and liver fat and intramyocellular fat in the tibialis anterior muscle by ^{1}H-MR spectroscopy in 220 subjects. Insulin sensitivity was estimated from the oral glucose tolerance test (OGTT) and measured by a euglycemic hyperinsulinemic clamp in a subgroup ($n = 157$).

Results:
Insulin sensitivity estimated from the OGTT correlated negatively with total body fat ($r = -0.27$, $p < 0.0001$), subcutaneous abdominal fat ($r = -0.35$, $p < 0.0001$), and visceral fat ($r = -0.43$, $p < 0.0001$). Furthermore, insulin sensitivity correlated negatively with liver fat ($r = -0.53$, $p < 0.0001$) and intramyocellular fat ($r = -0.26$, $p < 0.0001$). In multivariate regression models, high liver and visceral fat emerged as the strongest predictors of low insulin sensitivity.

Conclusion:
Among various fat compartments, high liver fat and high visceral fat are the strongest determinants of insulin sensitivity in humans.

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Abbreviations: (BMI) body mass index, (IMCL) intramyocellular lipids, (MR) magnetic resonance, (OGTT) oral glucose tolerance test

Keywords: ectopic fat, insulin resistance, intramyocellular fat, liver fat, visceral fat

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