

# Is there a predictive role for MRI assessed subcutaneous adipose tissue in identification of risk group for diabetes?

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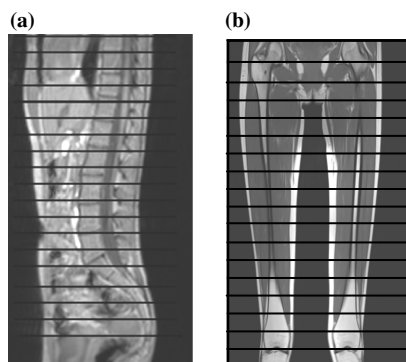
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## Introduction

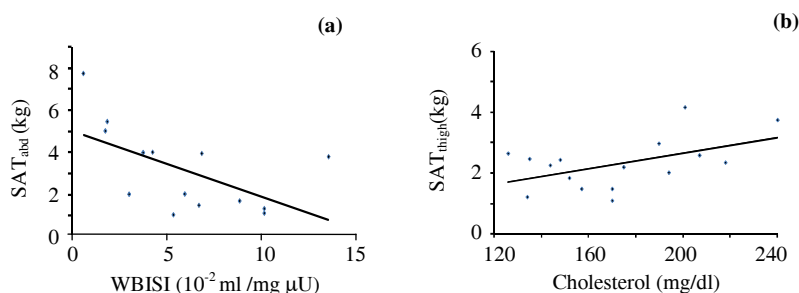
Increasing prevalence of diabetes has become a matter of great public health concern worldwide. This has heightened interest in identifying risk factors that can be used in prevention of diabetes (1). In this regard, body composition analysis has an important role to play and there are increasing number of studies focusing on fat distribution and its relation with biochemical / metabolic risk factors. A number of techniques such as MRI, Dual Energy X-ray Absorptiometry (DEXA) and Bio-impedance Analyser (BIA) can be used to assess body / subcutaneous fat (SF), an important risk factor for not only diabetes but also for conditions such as obesity and cardiovascular diseases. It has been shown that although these three techniques can be used interchangeably, MRI has the additional advantage of providing information on fat distribution and location specific details (2). Given the importance of adiposity as a crucial modifiable risk factor for diabetes, the present study has evaluated the predictive role of MRI assessed SF as an index of metabolic health by correlating it with biochemical diabetic risk factors such as insulin sensitivity, triglycerides, cholesterol, Low Density Lipoproteins (LDL) and High Density Lipoproteins (HDL). The study has been carried out in normal South Asian male population, known to have a high predisposition to type 2 diabetes (3).

## Materials and Methods

Twenty five healthy South Asian male volunteers in the age group of 17-35 yrs, having no history of diabetes and hypertension, were recruited for the study. MRI evaluation of Subcutaneous Adipose Tissue (SAT) in abdomen (SAT<sub>abd</sub>) and thigh (SAT<sub>thigh</sub>) was carried out at 1.5 T (Avanto, Siemens) using the following parameters: TR of 650 ms, TE of 11 ms, 256 x 256 matrix and 8mm contiguous slices. Transverse T<sub>1</sub>-weighted images were obtained from abdomen [T9 vertebra to the superior surface of hip joint (Fig. 1a)] using breath hold sequence and also from thigh [superior surface of hip joint to the lower end of medial condyle (Fig. 1b)]. Area of SF was assessed by drawing regions of interest for each slice, using which fat volume and mass were calculated. In 13 of the volunteers, single cross-sectional images were also obtained at mid-thigh and for abdomen at the level of L3-L4 intervertebral space. Body Mass Index (BMI), insulin sensitivity index using Glucose Tolerance Test, serum triglycerides, total cholesterol, Low Density Lipoprotein (LDL) and High Density Lipoprotein (HDL) were assessed using standard procedures (4). Correlation between parameters was determined using Pearson's correlation coefficient with p < 0.05 being considered statistically significant.



**Figure 1:** Transverse slices for (a) abdomen - T9 vertebra to hip joint (b) thigh - hip joint to medial condyle



**Figure 2:** Correlation of MRI assessed Subcutaneous Adipose Tissue (SAT) with [a] Whole body Insulin Sensitivity Index (WBISI) in abdomen [b] cholesterol in thigh

## Results and Discussion

Insulin sensitivity index showed significant negative correlation (i.e. positive association with insulin resistance) with SAT in abdomen (p < 0.05) (Fig. 2a) and mid-thigh (p = 0.02) but not with that from thigh region (p = 0.21). While LDL, HDL and triglycerides showed no significant association with SAT<sub>abd</sub> and SAT<sub>thigh</sub>, there was significant correlation between cholesterol, and SAT<sub>abd</sub> (p < 0.05) and SAT<sub>thigh</sub> (p < 0.05) (Fig. 2b). As the prevalence of conditions like diabetes and cardiovascular diseases increase worldwide, adiposity, one of the predisposing factor associated with these diseases need to be quantified and correlated with other functional risk factors. Although the results in this study are in general agreement with those in literature, the reported fat assessments have been made using Computerized Tomography (5). To the best of our knowledge, there are no previous reports on the association between MRI assessed SAT and insulin sensitivity in healthy volunteers.

## Conclusion

There is growing evidence that South Asian men in comparison to Europeans have a higher prevalence of insulin resistance, predisposing them to type 2 diabetes. Further, in this group, lower appendicular body fat as opposed to abdominal fat is reported to be associated with severity of insulin resistance (3). In this context, the results of the current study carried out on South Asian males is interesting and relevant - in particular, the positive association of MRI assessed subcutaneous adiposity in mid-thigh with insulin resistance. In addition, there were also positive correlations between SAT and cholesterol in abdomen and thigh. Studies are also underway to correlate triglycerides evaluated in liver and soleus muscle using proton MRS with insulin sensitivity and lipid profile. Although a more detailed study and in a larger population is under way to draw definite inferences, the present results support the conclusion that in South Asian males, MRI assessed SAT in mid-thigh (in particular) could be an independent risk factor and correlate of insulin resistance. It can play a predictive role in identifying the risk population for diabetes.

## References

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