A. Computerized tomography (CT) scanning

The objective of these measurements was to assess abdominal visceral, subcutaneous and liver fat compartments. Axial 3-mm sections were taken through the midvertebral bodies of L1, L2, L3, L4, L5 lumbar vertebrae. The specific levels to be scanned were localized from an initial sagittal topogram. The scans were performed using a somatom 16-slice MDCT scanner (Siemens Medical solutions, Malvern, PA) using 120kV and 200mA and utilizing slice thickness of 3-8mm, a matrix of 512x512 and pixel size 0.585 – 0.859 mm. No I.V. or oral contrast was used. A CT range of -120 to -40 Hounsfield units was used to encompass all fat. The total cross-sectional area was calculated at each level so that intra-abdominal, subcutaneous and total fat could be calculated using Adode Photoshop Elements 5 (Adobe system incorporated, San Jose, CA). In our laboratory intra-scorer and inter-scorer (for two scorers) correlation co-efficient for CT fat assessment using Adobe is 0.98 and 0.97 respectively.

Subcutaneous adipose tissue was defined as fat between the skin surface and the outer margin of the back and abdominal wall musculature, while intra-abdominal fat was defined as fat within the cavity formed by the back and abdominal wall musculature. We chose Adobe Photoshop over other software for abdominal fat quantification because it allows manual selection of subcutaneous/visceral fat. This is possible with the use of “magic wand” with which we outline regions of similar signal intensity. An advantage of this method is that it allows corrections to be done by the operator unlike other commercially available automated packages. For example Tera-Recon calculates the subcutaneous and visceral fat surface area reliably using set Hounsfield thresholds, which works in most cases. However when the abdominal wall muscles are thin the software may overestimate the subcutaneous and underestimate visceral fat. Below is an example of Tera-recon software analysis in one of our patients where misquantification of subcutaneous fat occurred. In such cases, the operator has no ability for manual manipulations.

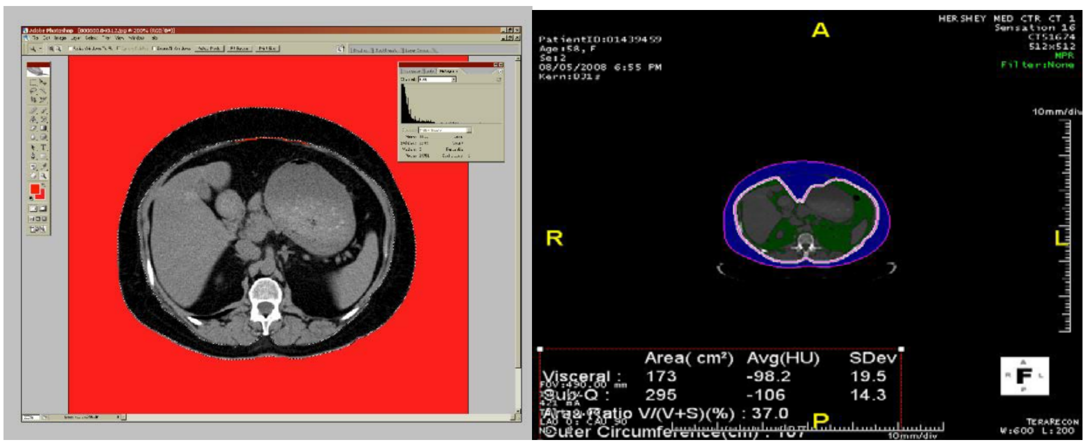


Image on the left is from Adobe Photoshop showing manual drawing of a red line where the abdominal wall is thin. Image on the right is from Tera-recon showing that as a consequence of the thin abdominal wall, the subcutaneous fat is grossly overestimated. This patient would be excluded from the study using Tera-recon software; however with the use of Adobe Photoshop, the correct analysis can be made.

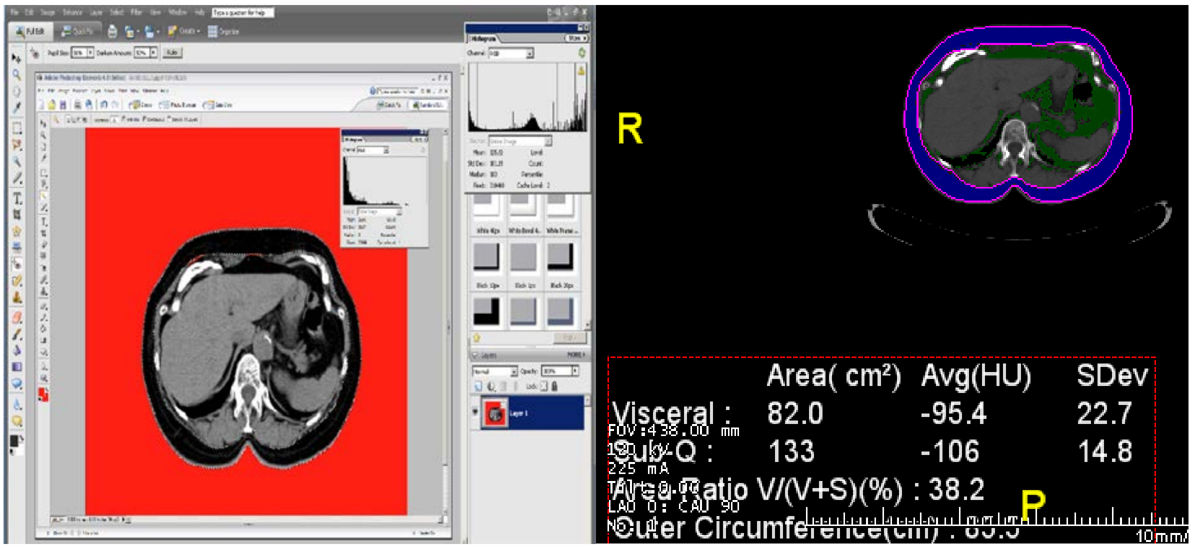
Assessment of all five CT slices of two participants was repeated with Adobe/Tera-Recon by the same operator, and correlation between the two programs was high. Below we provide raw data as well as photos for all five lumbar levels from one of these subjects. It is obvious that Tera-Recon most of the times overestimates visceral fat, due to assessment of intestine air as fat. As we stated previously, this cannot be corrected manually.

	Visceral (cm^2)		**Subqutaneous (cm^2)**		**Visceral/ total fat**	
	Tera-Recon	*Adobe*	Tera-Recon	*Adobe*	Tera-Recon	*Adobe*
L1	82	*87*	133	*150*	38.2	*36.6*
L2	87	*76*	162	*178*	35	*30*
L3	117	*103*	212	*229*	35.5	*31*
L4	133	*122*	279	*229*	32.2	*30*

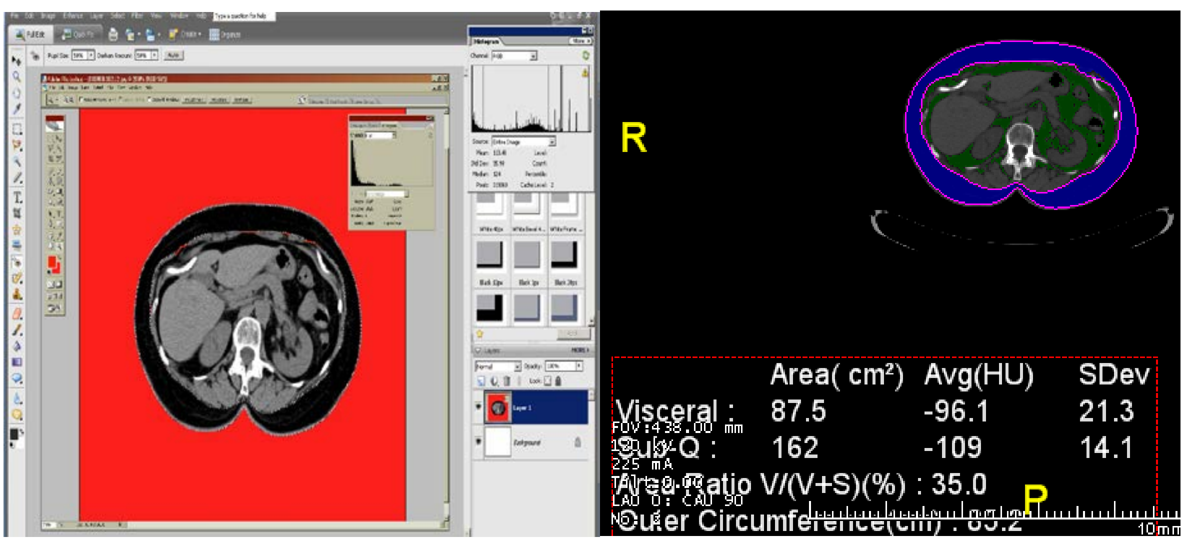
L5	160	*145*	308	*324*	34	*31*

CT slices of one subject using Adobe (left) and Tera-Recon (right)

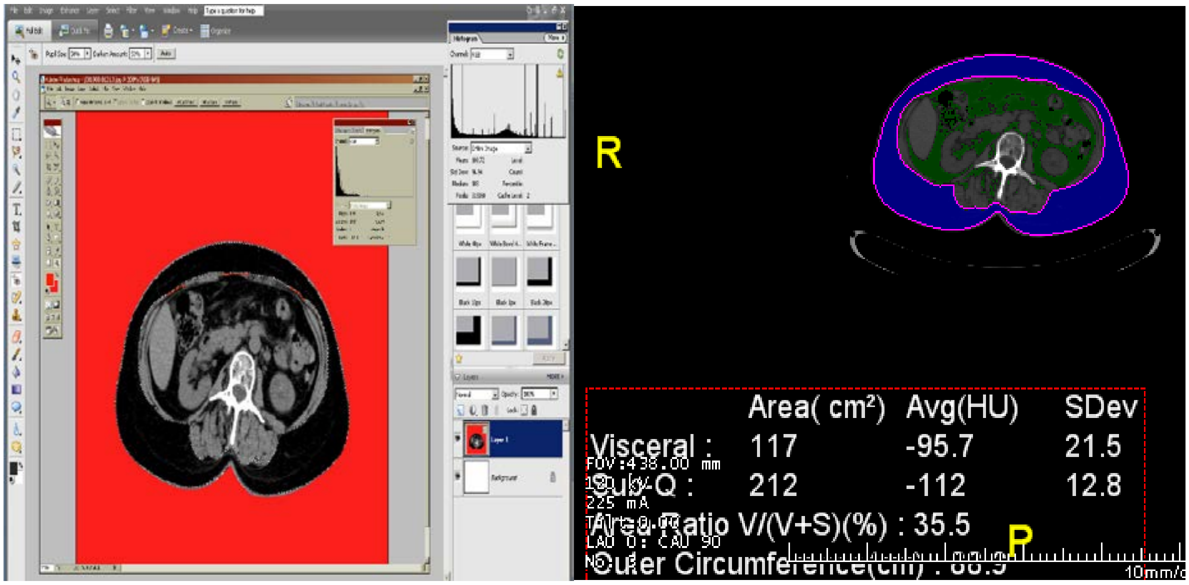
L1



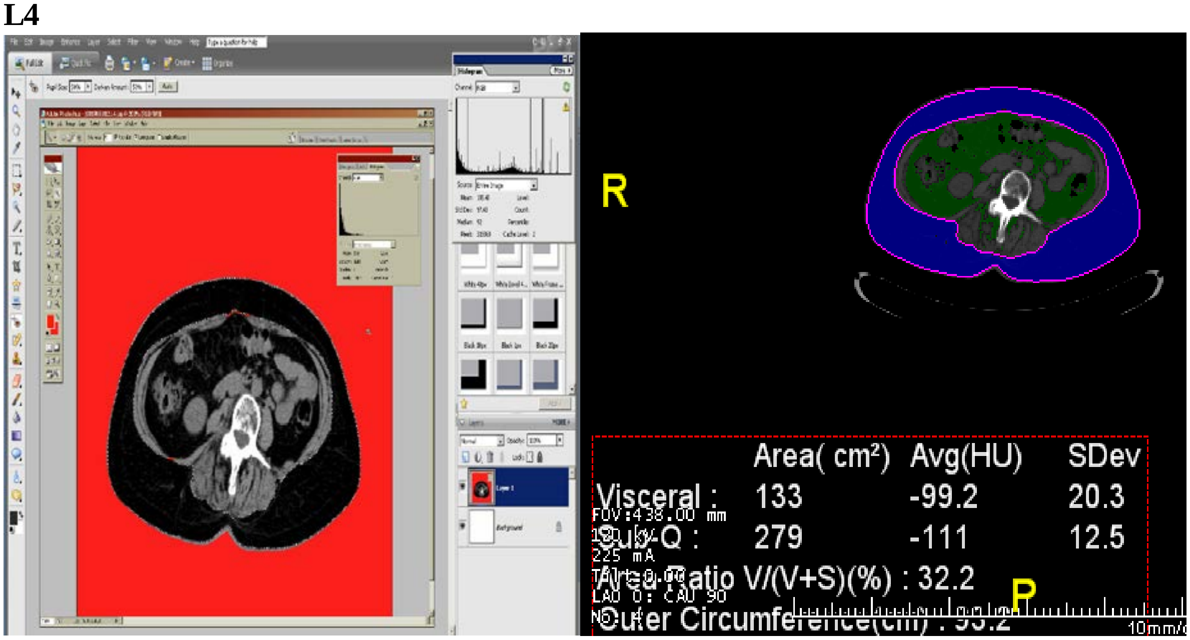
L2



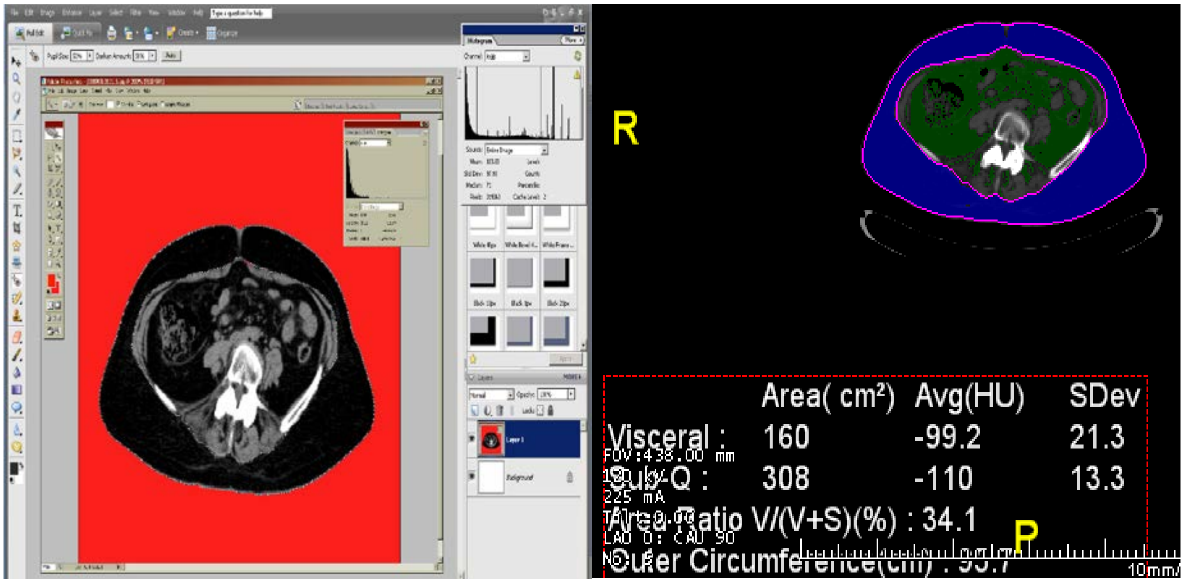
L3


R
Area(cm²) Avg(HU) SDev
Visceral : 117 -95.7 21.5
Sub-Q : 212 -112 12.8
Area Ratio V/(V+S)(%) : 35.5
Outer Circumference(cm)
FOV:438.00 mm
225 mA
LAO 0: CAU 90
P

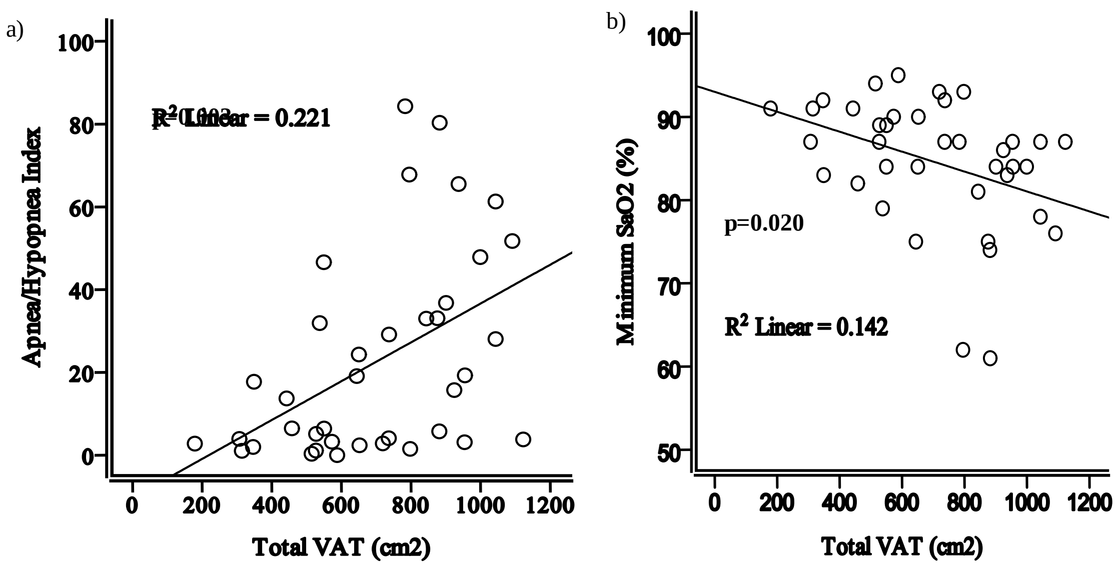
L4


R
Area(cm²) Avg(HU) SDev
Visceral : 133 -99.2 20.3
Sub-Q : 279 -111 12.5
Area Ratio V/(V+S)(%) : 32.2
Outer Circumference(cm)
FOV:438.00 mm
225 mA
LAO 0: CAU 90
P

L5



B. Associations of apnea and abdominal fat within men and women



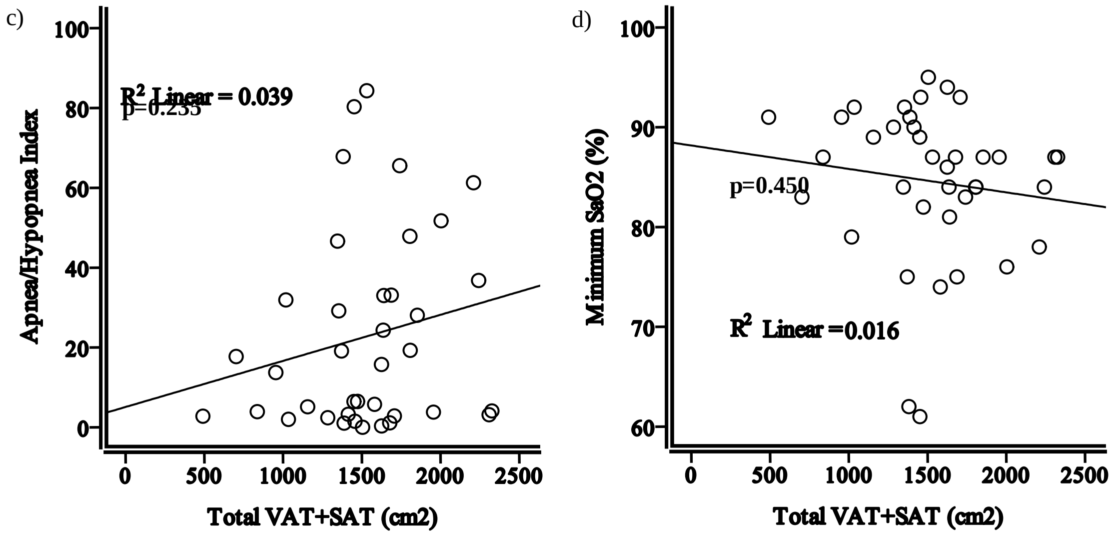


Figure 1. Associations between apnea severity (AHI and minimum SaO_2) and total visceral adipose tissue (Total VAT) and total abdominal fat in control and apneic men. (AHI: Apnea/Hypopnea Index, minimum SaO_2: minimum oxygen hemoglobin saturation)

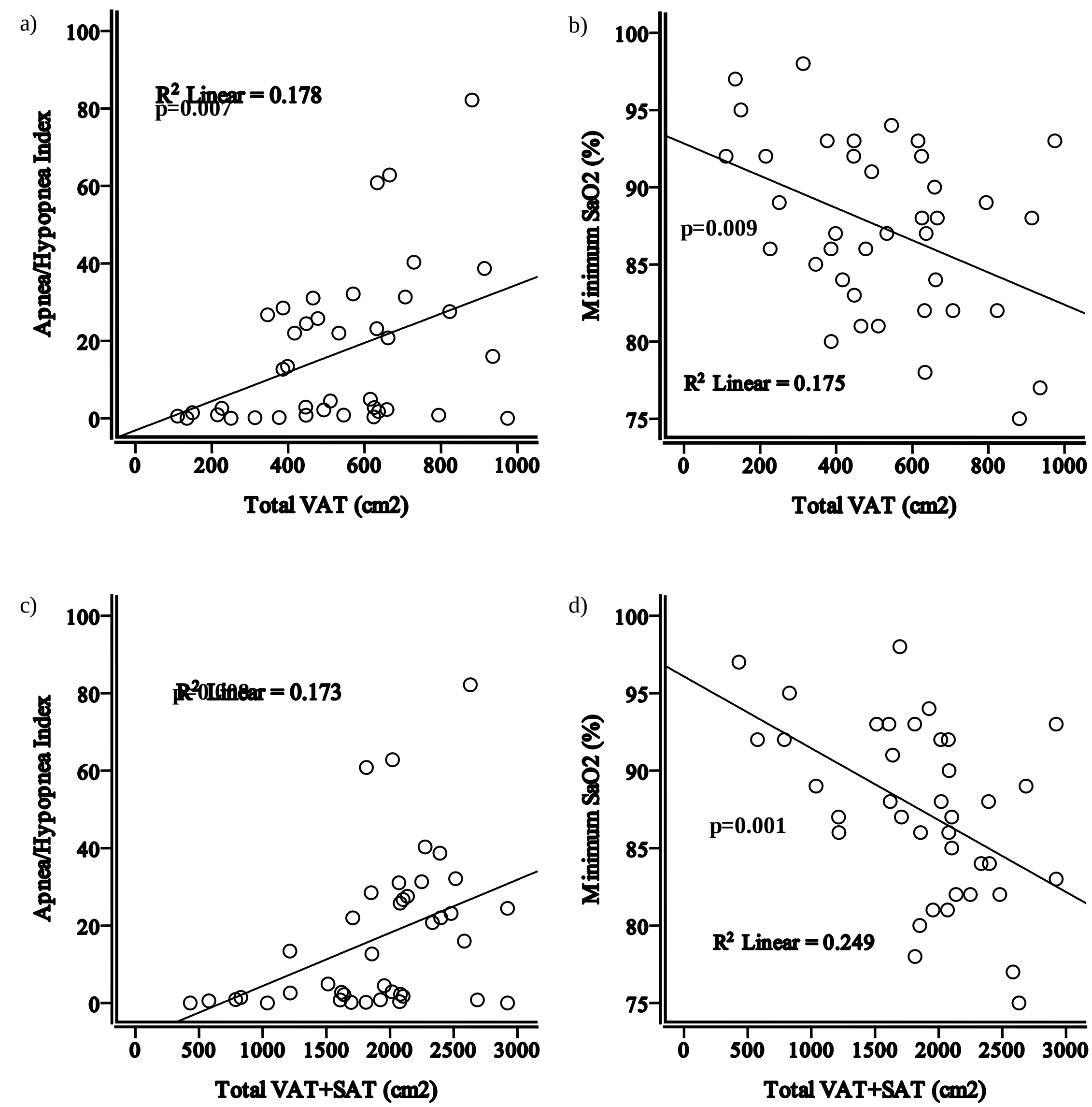


Figure 2. Associations between apnea severity (AHI and minimum SaO_2) and total visceral adipose tissue (Total VAT) and total abdominal fat in control and apneic women. (AHI: Apnea/Hypopnea Index, minimum SaO_2: minimum oxygen hemoglobin saturation)