INVESTIGATION OF PERIPHERAL AND CEREBRAL MICROCIRCULATION AND VISCERAL-SUBCUTANEOUS ADIPOSE TISSUE DISTRIBUTION IN DIABETES AND OBESITY

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Background: Microcirculation is damaged in diabetic patients and it has also been observed in obesity. Damage to microcirculation affects both cerebral and peripheral microvessels. Abdominal obesity and type 2 diabetes mellitus are important risk factors for vascular disorders. Visceral adipose tissue (VAT) carries greater cardiometabolic risk than subcutaneous adipose tissue (SAT).

Methods: Participants (diabetic group: 20 female and 32 male, mean age: 51.0±6.9 year, BMI: 33.0±5.1 kg/m^2; obesity group: 26 female and 21 male, mean age: 51.5±10.5 year, BMI: 38.8±6.1 kg/m^2) were recruited from the obesitology and diabetology outpatient department of Internal Medicine, University of Debrecen and were involved just after a written consent accepted by the local ethical committee was obtained. Tc99m HMPAO dynamic SPECT/CT studies were performed to assess cerebral and peripheral microcirculation. Quantification of visceral and subcutaneous fat tissue was performed in axial planar low-dose CT images taken at the level of LI vertebra. Within the slice semi-automatic segmentation of different regions of adipose tissue after manual selection of ROIs (region of interest) was done. Fat distribution results were expressed as VAT/SAT ratio (VSR), IAA – intra abdominal area and Sra – subcutan/total fat ratio. HbA1c, blood glucose and lipid levels were also determined. Non-parametric Spearman correlation tests with FDR corrections were applied as statistical analysis.

Aim of the study: Our main aim was to investigate the effect of fat distribution on cerebral and peripheral perfusion and find any association with laboratory parameters in obesity and type 2 diabetes.

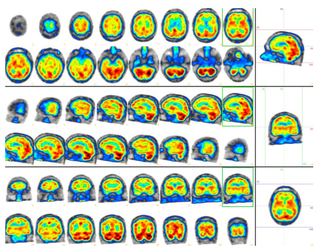

Figure 1. Investigation of brain perfusion with Lehr collimator

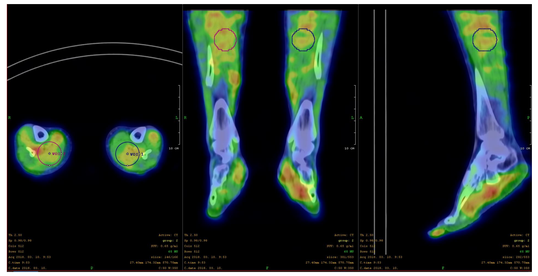

Figure 2. Lower limb perfusion

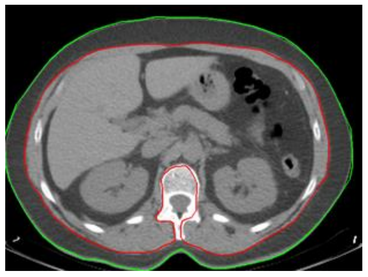

Figure 3. CT-Visceral/Subcutaneous fat

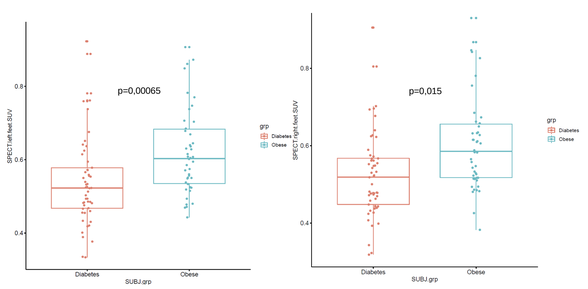

Figure 4. Left and right foot SUV

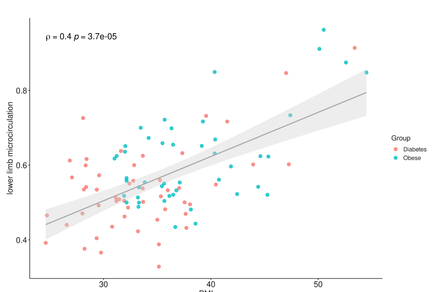

Figure 5. Lower limb microcirculation and BMI

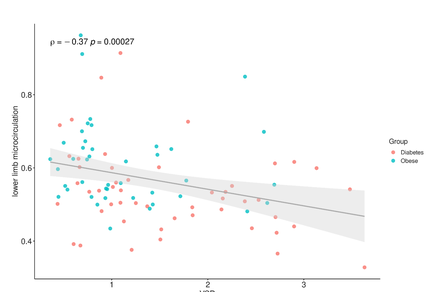

Figure 6. Lower limb microcirculation and VSR

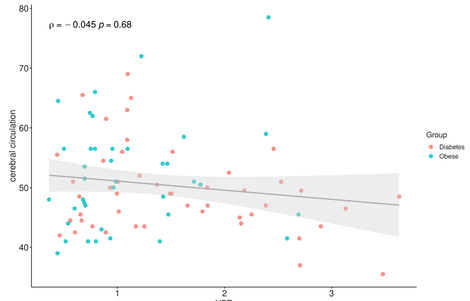

Figure 7. Brain circulation and VSR

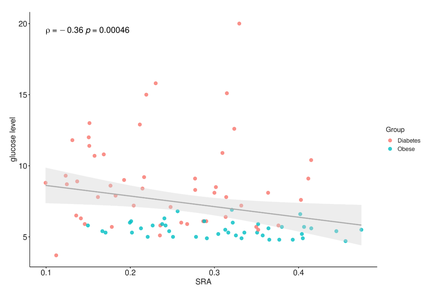

Figure 8. Sra and fasting glucose levels

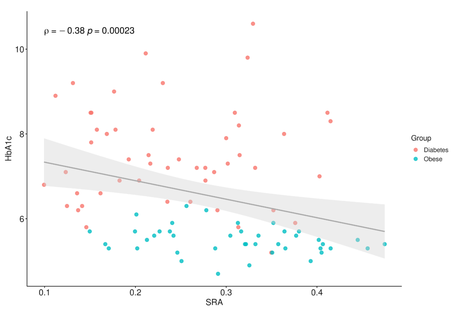

Figure 9. Sra and HbA1c

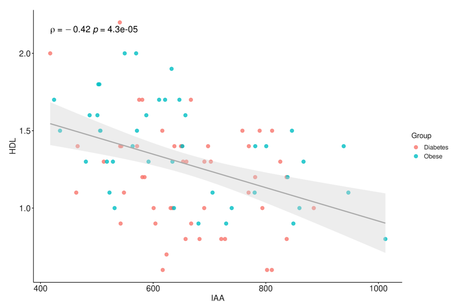

Figure 10. IAA and HDL

	Obesity mean	Obesiy SD	Diabetes mean	Diabetes SD	Wilcoxon p
age	51.5	10.5	51	6.9	0.57045
BMI	**38.8**	**6.1**	**33**	**5.1**	**0.00004**
HbA1C	**5.5**	**0.3**	**7.6**	**1.2**	**<0.00001**
Triglicerid	1.7	0.8	2.8	3.1	0.22437
Koleszterin	5.4	1.2	4.8	1	0.0183
HDL.C	1.4	0.3	1.2	0.3	0.08984
LDL.C	**3.8**	**1.1**	**2.9**	**1**	**0.00115**
GFR	87.6	5	84.5	12.6	0.33972
Foot SUV mean	**0.6**	**0.1**	**0.5**	**0.1**	**0.0011**
Brain perf. mean	53.6	11.4	49.1	7	0.17201

Table 1. Detailed measurement data for diabetic and obese patients

Results: Leg perfusion was significantly lower in the diabetic group (p=0.0011) and it correlated significantly with BMI (p=0.000037, rho:0.4). However, there were no significant differences in hemispheral and regional brain perfusion between T2DM and obese patients.
Significant negative correlation of lower limb microcirculation with VSR was revealed (p=0.00027, rho:-0.37), while VSR had no impact on cerebral circulation. Significant negative correlations between Sra and fasting glucose levels (p=0.00046, rho:-0.36), furthermore Sra and HbA1c (p=0.00023, rho:-0.38) were found. Negative association between IAA and HDL (p=0.000043, rho:-0.42) could also be detected.

Conclusion: Visceral fat tissue has negative effect on HDL, fasting glucose and HbA1c levels and highly contributes to the demage of peripheral microcirculation in patients with obesity and diabetes.