Insulin resistance, not obesity determines fatty liver in obese children

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Backgrounds and aims

Pediatricians face an uprise in the prevalence of childhood obesity and related comorbidities, including insulin resistance, progression from normal glucose tolerance to overt type 2 diabetes mellitus and non-alcoholic fatty liver disease. The underlying mechanisms related to the changes in insulin sensitivity (IS) are poorly understood. The present study examined the association of liver fat deposition with IS in obese children.

Design and methods

Intrahepatocellular lipids (IHCL) of 26 obese Caucasian children (clinical characteristics s. table 1) were assessed by magnetic resonance spectroscopy: ^{1}H single-voxel spectroscopy (SVS) STEAM sequence was used (TR = 2s, TE = 20ms, AVG=4) at 3T MR-System (Bruker BioSpin MRI) with a surface coil of 10 cm diameter. The VOIs (3 x 3 x 3 cm^3) were positioned according to MRI in the liver tissue avoiding blood vessels, the gall bladder, and fatty tissue. Liver spectra were acquired during one breath hold of 8 seconds. Hepatic fat percentage was calculated by dividing (100 x S_{IHCL}) by the sum of the relative peak integrals (S_{water} + S_{IHCL}).

Insulin sensitivity was estimated by the whole body insulin sensitivity index (WBISI), a parameter obtained from an oral glucose-tolerance test OGTT, that describes insulin action in dynamic conditions, and homeostatic model assessment (HOMA-R).

Results

Obese insulin resistant children had significantly higher HCL than their insulin sensitive counterparts (36.5±8.7 vs. 18.7±9, p=0.02). Body mass index (BMI) correlated negatively with WBISI (R=-0.56, p=0.003) but was not associated with HCL (R=0.27, p=0.18). HCL correlated negatively with WBISI (R= -0.52, p=0.011) even after adjustment for BMI (Fig. 1).

Conclusions

The present study demonstrates that insulin resistance, but not obesity determines fatty liver in obese children.

	Mean±SE	Range
Age (years)	10.96±0.72	10-12
Tanner classification	1.3±0.3	1-2
BMI (kg/m²)	31.9±4.7	25.1-41.1
BMI-SDS	2.69±0.4	1.98-3.4
Waist circumference (cm)	100.1±11.1	83.0-122.0
120 min Glucose (mg/dl)	96.2±24.5	53-128
Fasting glucose (mg/dl)	82.1±17.1	59-125
Fasting insulin (mU/l)	22.2±9.3	6.4-43.3
WBISI	2.8±1.5	0.78-6.18

Tab. 1: Clinical characteristics

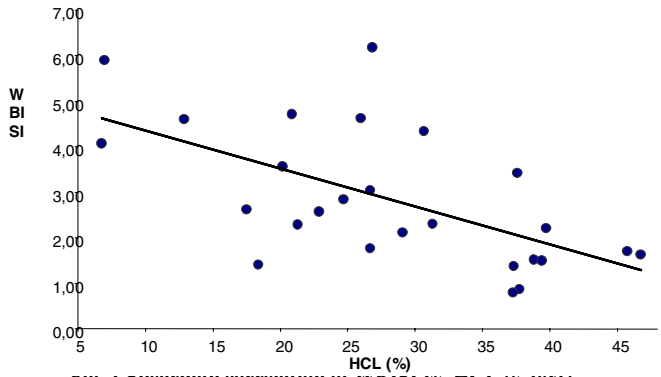
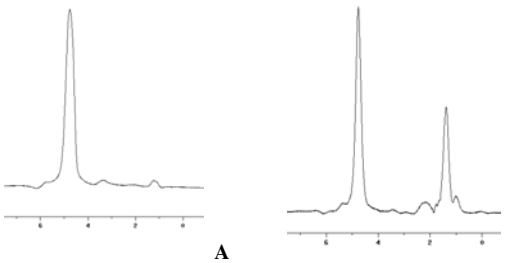


Fig. 1 Spearman correlation of WBISI vs. HCL (s. text)



A **B Fig. 2: MR spectra of children with A low (6.6%) vs. B high (47.8%) HCL**