Non-invasive assessment of liver steatosis: usefulness of elastography in obese children – a pilot study.

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Introduction

Non-alcoholic fatty liver disease (NAFLD) is diagnosed in up to 60% of overweight children. Diagnosis and management of NAFLD is challenging due to the lack of non-invasive imaging biomarkers. Ultrasound (US) is the most widely non-invasive method used to identify liver steatosis, however it has low sensitivity to detect mild steatosis and to quantify hepatic fibrosis. Liver Elastography (LE) is a non-invasive methodology used to evaluate hepatic stiffness and fat deposition. Few studies have evaluated the reliability of LE in pediatric obesity.

Objectives

1) To assess hepatic stiffness and shear-wave velocity (SWV) by LE in obese children and adolescents;
2) to compare LE findings with hepatic echogenicity evaluated by conventional US;
3) to evaluate the correlation between hepatic stiffness and clinical and biochemical indices of cardio-metabolic risk.

Results

Mean age and BMI SD were 11.6±2.3 years and 3±0.6, respectively. Mean age at onset of obesity was 5.6±2.6 years. Liver steatosis was documented by conventional US in 16 patients (mild steatosis in 56%, moderate in 37.5%, severe in 6%). Mean stiffness was 10.66±1.9 kPA; mean SWV was 1507.5±43.2 m/s. The presence of steatosis was directly correlated to waist circumference (p=0.036), total cholesterol (p=0.014), triglycerides (p=0.043), ALT (p=0.040), AST (p=0.006), GGT (p=0.000), triglycerides/HDL-ratio (p=0.024). At the multivariate regression analysis, total cholesterol, triglycerides, triglycerides/HDL-ratio, total cholesterol/HDL-ratio, were independent predictors of steatosis (Fig. 1).

No correlations were demonstrated between presence of steatosis and glucose metabolism indices. Stiffness and SWV were not significantly correlated with any anthropometric, bioimpedenziometric and biochemical variables (Tab. 1).

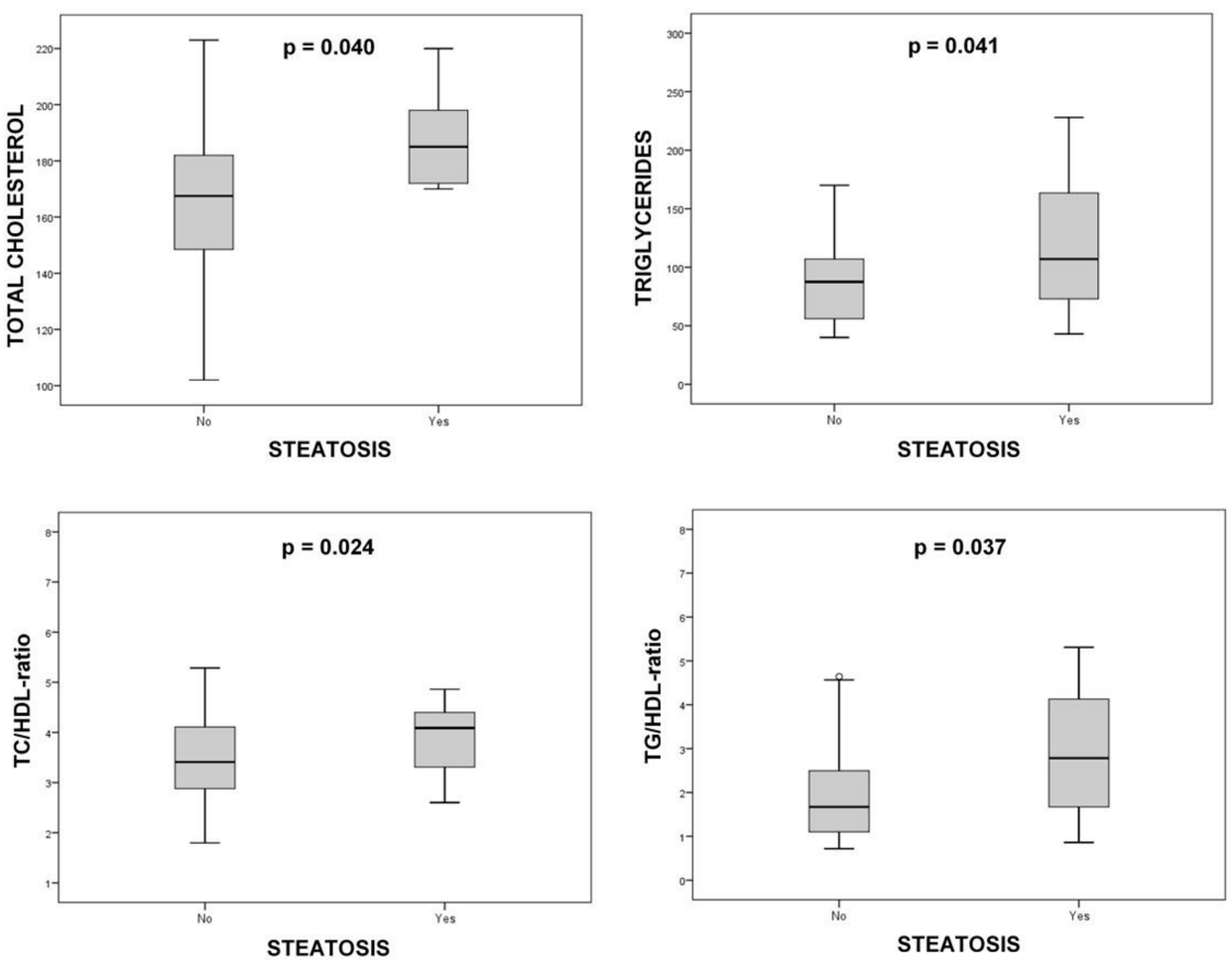

Figure 1 – Box plot – Distribution of patients with or without hepatic steatosis in accordance with the four significant variables at logistic regression analysis.

Material and methods

Eighty children with simple obesity (55% female, 45% male) were recruited according to the following criteria: no genetic or endocrine causes of obesity; no associated chronic diseases neither chronic therapies. All patients underwent anthropometric, bioimpedenziometric and biochemical (lipid profile, oral glucose tolerance test, thyroid, kidney and liver function tests) assessments. HOMA-IR, Matsuda-index, Insulinogenic index, oral disposition index, insulin and glucose Areas Under the Curves were evaluated. In each patient, both conventional liver US and LE were performed by two radiologists; stiffness and SWV were measured.

Tab. 1 – Correlation analysis.

		Mean stiffness (KpA)	Maximum stiffness (KpA)	SWV (m/s)
BMI SD	r	0,071	0,015	-0,026
	p	0,542	0,896	0,818
WC	r	-0,045	0,059	-0,023
	p	0,697	0,606	0,843
WC/height	r	0,002	0,079	0,065
	p	0,988	0,489	0,569
HOMA-IR	r	-0,012	-0,039	0,130
	p	0,916	0,737	0,252
Matsuda-index	r	0,088	0,037	-0,126
	p	0,445	0,748	0,265
IGI	r	0,003	0,009	0,058
	p	0,978	0,940	0,612
ODI	r	0,055	0,012	0,008
	p	0,633	0,918	0,946
AUC-ratio	r	-0,017	0,089	0,030
	p	0,885	0,440	0,790
Total cholesterol	r	-0,110	0,138	0,009
	p	0,343	0,228	0,938
HDL	r	0,146	0,086	-0,020
	p	0,204	0,452	0,863
LDL	r	-0,108	0,138	0,012
	p	0,350	0,230	0,918
Triglycerides	r	0,001	0,012	0,140
	p	0,991	0,915	0,215
ALT	r	-0,075	-0,004	-0,004
	p	0,518	0,973	0,974
AST	r	0,112	-0,095	0,049
	p	0,330	0,407	0,664
Gamma-GT	r	-0,178	0,005	0,042
	p	0,121	0,963	0,715
FAT MASS	r	-0,083	-0,027	-0,080
	p	0,472	0,815	0,480
FAT FREE MASS	r	-0,022	-0,025	-0,085
	p	0,851	0,825	0,456
Diagnosis of Steatosis at US	r	-0,126	-0,042	-0,081
	p	0,274	0,716	0,477

Shear-wave velocity (SWV), Waist circumference (WC), Insulinogenic index (IGI), oral disposition index (ODI), ratio of insulin and glucose Areas Under the Curves (AUC-ratio).

Conclusions

In obese children, the presence of steatosis is significantly influenced by lipid profile alterations. In our cohort, stiffness and SWV did not correlate with presence of steatosis, severity of obesity, anthropometric, bioimpedenziometric, biochemical indices of cardio-metabolic risk. LE does not seem to provide additional information compared to conventional US, probably because NAFLD is not usually associated with hepatic fibrosis in pediatric obesity

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