Toward a simple marker of hepato-visceral adiposity and insulin resistance: the Z-score change from weight-at-birth to BMI-in-childhood

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Introduction

Insulin resistance and hepato-visceral (central) fat excess are thought to contribute to an earlier timing of adrenarche/pubarche and puberty/menarche; this earlier timing, in turn, relates often to a mismatch between prenatal and postnatal weight gain, which can be estimated by calculating the Z-score change from birth weight (BW) to body mass index (BMI) in childhood.

AIM

To test whether the Z-score change from birth weight (BW) to body mass index (BMI) in childhood may serve as a proxy of insulin resistance and hepato-visceral adiposity in prepuberty.

Subjects & Methods

- We reappraised a cohort of children (age, 8.5 years), born appropriate- (AGA, n=41) or small-for-gestational age (SGA, n=45), followed since birth (n=76) or since the age of 3 years (n=10).
- Assessments included anthropometry; fasting glucose and insulin; liver volume; and hepatic fat, subcutaneous fat, and visceral fat in the abdominal region (by magnetic resonance imaging [MRI]). BW and gestational age were retrieved from medical records; BWZ-scores and BMI Z-scores for postnatal age and sex were derived from country-specific references.

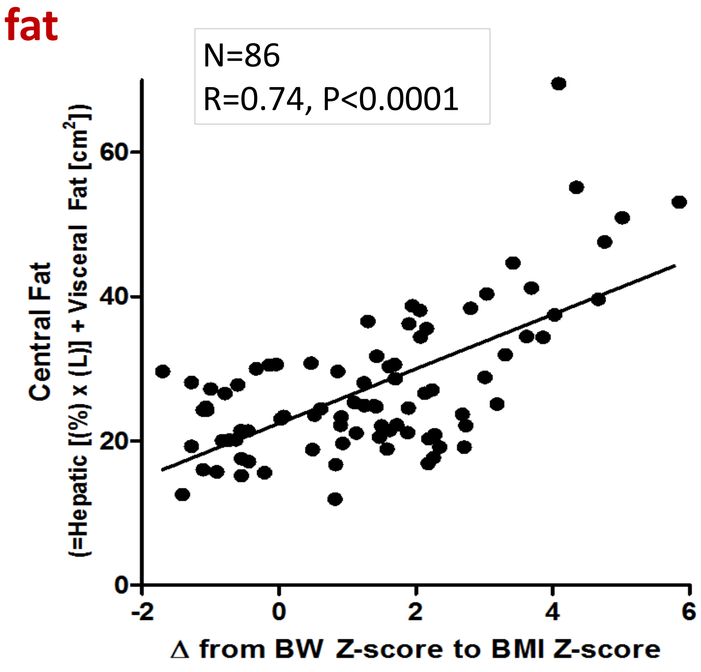
Results

Clinical, endocrine-metabolic and imaging assessments

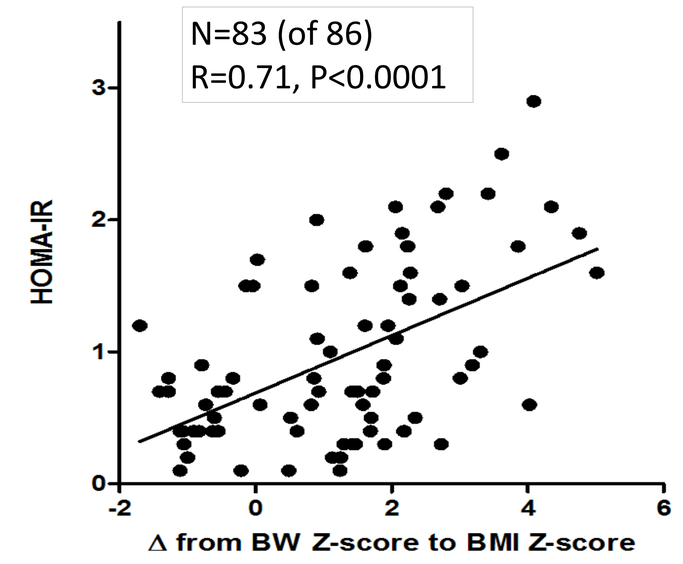
	All AGA (n=41)	All SGA (n=45)	All population (n=86)
Birth data			
Birth Weight (Kg)	3.3 ± 0.0	2.3 ± 0.0	2.7 ± 0.1
Birth Weight Z-score	-0.1 ± 0.1	-2.4 ± 0.1	-1.3 ± 0.1
Breastfeeding (n,%)	36 (88%)	14 (31%)	50 (58%)
Anthropometry			
Age (yr)	8.5 ± 0.2	8.5 ± 0.1	8.5 ± 0.1
Weight Z-score ^	0.1 ± 0.2	-0.2 ± 0.2	0.0 ± 0.1
Height Z-score ^	0.2 ± 0.2	-0.5 ± 0.2	-0.2 ± 0.1
BMI Z-score ^	0.0 ± 0.2	0.0 ± 0.2	0.0 ± 0.1
Endocrine-Metabolic Variables			
Glucose (mg)	88 ± 1	87 ± 1	87 ± 1
HOMA-IR	1.0 ± 0.1	1.2 ± 0.2	1.1 ± 0.1
IGF-I (ng/mL)	166 ± 10	202 ± 14	183 ± 9
Triglycerides (mg/dL)	59 ± 7	57 ± 3	58 ± 4
HDL-Cholesterol (mg/dL)	61 ± 2	58 ± 2	59 ± 1
LDL-Cholesterol (mg/dL)	100 ± 4	94 ± 4	97 ± 3
HMW adiponectin (mg/L)	11 ± 1	10 ± 1	10± 1
Abdominal MRI			
Total liver volume (mL)	712 ± 20	695 ± 18	702 ± 13
Hepatic fat (%)	13 ± 1	16 ± 1	15 ± 1
Subcutaneous (Sc) fat (cm^2)	40 ± 5	54 ± 8	48 ± 5
Visceral (Vs) fat (cm^2)	15 ± 1	18 ± 1	17 ± 1
Central fat [(% x L) + cm^2]	25 ± 1	29 ± 1	27 ± 1

Pearson correlations between the change (Δ) from BW Z-score to BMI Z-score and:

✓ **Central fat**



✓ **HOMA-IR**



Conclusions

- The higher the Z-score increment from weight-at-birth to BMI-in-childhood, the more central fat, and the more insulin resistance.
- Our results suggest that Z-score change BW-BMI could be viewed as a simple candidate-marker for hepato-visceral adiposity and insulin resistance in prepubertal children.