

Background

Children born small-for-gestational age (SGA), especially those who experience spontaneous postnatal catch-up growth, are at increased risk for developing insulin resistance, central adiposity and cardiovascular abnormalities later in life. By age 3-6 years, SGA children have a broader carotid intima media thickness (cIMT) and more pre-peritoneal fat.

Subjects/ Assessments

The studied population consisted of 61 AGA (48% girls) and 26 SGA (50% girls), born after uncomplicated, term pregnancies. By the age 1 year, all children had experienced spontaneous catch-up in weight and height.

Longitudinal assessments included:

- Body height and weight .
- Endocrine-metabolic markers (fasting glucose, insulin, IGF-I, high-molecular-weight [HMW] adiponectin)
- Cardiac markers (homocysteine, heart type fatty-acid binding protein [H-FABP])
- Body composition (by dual X-ray absorptiometry [DXA]).
- Abdominal fat distribution, cIMT, aortic IMT (aIMT) (by ultrasound [US]).
- Cardiac morphometry and function (by echocardiography).

Objective

To study whether cIMT and pre-peritoneal fat differ already between catch-up SGA infants and appropriate-for-gestational age (AGA) controls at age 1 and 2 years, and whether such differences - if any- are accompanied by differences in cardiac morphology and function, endocrine-metabolic markers, cardiac markers and body composition.

Results

Table. Study variables in appropriate-for-gestational-age (AGA) versus small-for-gestational-age (SGA) infants.

	AGA			SGA		
	At birth	1 year	2 years	At birth	1 year	2 years
	(N=60; 47% girls)	(N=60; 47% girls)	(N=50; 47% girls)	(N=27; 48 % girls)	(N=27; 48 % girls)	(N=18; 50% girls)
Birth weight (kg)	3.3 ± 0.0	-	-	2.3 ± 0.0^c	-	-
Birth weight Z-score	0.0 ± 0.1	-	-	-2.3 ± 0.1^c	-	-
Clinical characteristics						
Age (days)	14 ± 0	383 ± 5	746 ± 4	14 ± 1	382 ± 8	742 ± 5
Weight Z-score	0.0 ± 0.1	-0.2 ± 0.2	-0.2 ± 0.1	-2.3 ± 0.1^c	-0.8 ± 0.2	-0.8 ± 0.2
Length Z-score	0.1 ± 0.1	0.0 ± 0.2	-0.4 ± 0.2	-1.6 ± 0.1^c	-0.4 ± 0.2	-0.7 ± 0.2
Endocrine-metabolic and cardiac markers						
Glucose (mmol/L)	4.3 ± 0.2	4.7 ± 0.1	4.4 ± 0.1	4.0 ± 0.3	4.8 ± 0.1	4.3 ± 0.1
IGF-I (ng/mL)	50 ± 4	45 ± 3	61 ± 4	32 ± 2^b	55 ± 7	70 ± 10
Insulin (pmol/L)	43.5 ± 4.7	21.7 ± 3.2	17.3 ± 2.6	29.6 ± 3.5^b	21.4 ± 6.2	9.3 ± 2.1
HMW Adiponectin (mg/mL)	25.2 ± 1.2	22.0 ± 2.5	17.2 ± 1.5	27.0 ± 2.8	17.7 ± 1.8	13.6 ± 1.5
Homocysteine (µmol/L)	-	5.6 ± 0.3	5.0 ± 0.2	-	5.3 ± 0.2	5.4 ± 0.3
H-FABP (ng/mL)	-	2.4 ± 0.2	2.0 ± 0.1	-	2.3 ± 0.2	2.2 ± 0.2
Body composition (DXA)						
BMC (g)	89 ± 1	243 ± 7	357 ± 7	63 ± 3^c	229 ± 11	357 ± 14
Lean mass (g)	3056 ± 46	6904 ± 134	8934 ± 122	2261 ± 42^c	6031 ± 296^b	8060 ± 242^c
Fat mass (g)	851 ± 26	3362 ± 107	3798 ± 100	489 ± 25^c	3137 ± 106	3599 ± 210
Abdominal fat (g)	40 ± 2	186 ± 10	196 ± 11	19 ± 1^c	174 ± 13	158 ± 13
Abdominal fat distribution (US)						
Visceral fat (mm)	-	37.8 ± 0.9	34.8 ± 1.0	-	38.9 ± 1.5	36.7 ± 1.5
Subcutaneous fat (mm)	-	3.1 ± 0.1	3.0 ± 0.1	-	3.1 ± 0.1	3.1 ± 0.2
Pre-peritoneal fat (mm)	-	1.4 ± 0.1	1.2 ± 0.1	-	1.6 ± 0.1	1.6 ± 0.2^b
Intima-media thickness (IMT, US)						
Carotid IMT (µm)	-	286 ± 3	296 ± 3	-	315 ± 4^c	316 ± 4^c
Aortic IMT (µm)	-	635 ± 11	633 ± 13	-	625 ± 10	613 ± 15
Cardiac morphology and function						
Sphericity Index Z-score	-	1.5 ± 0.02	1.5 ± 0.02	-	1.6 ± 0.02	1.5 ± 0.02
Ejection Fraction (Teich) (%)	-	71.9 ± 0.7	73.9 ± 0.9	-	73.9 ± 0.9	70.4 ± 0.9
TAPSE (mm)	-	16.7 ± 0.4	19.1 ± 0.3	-	16.4 ± 0.4	18.2 ± 0.7
Ratio Mitral valve E/A	-	1.5 ± 0.0	1.5 ± 0.1	-	1.3 ± 0.1	1.4 ± 0.1
Ratio Tricuspid valve E/A	-	1.3 ± 0.0	1.3 ± 0.0	-	1.3 ± 0.1	1.3 ± 0.1

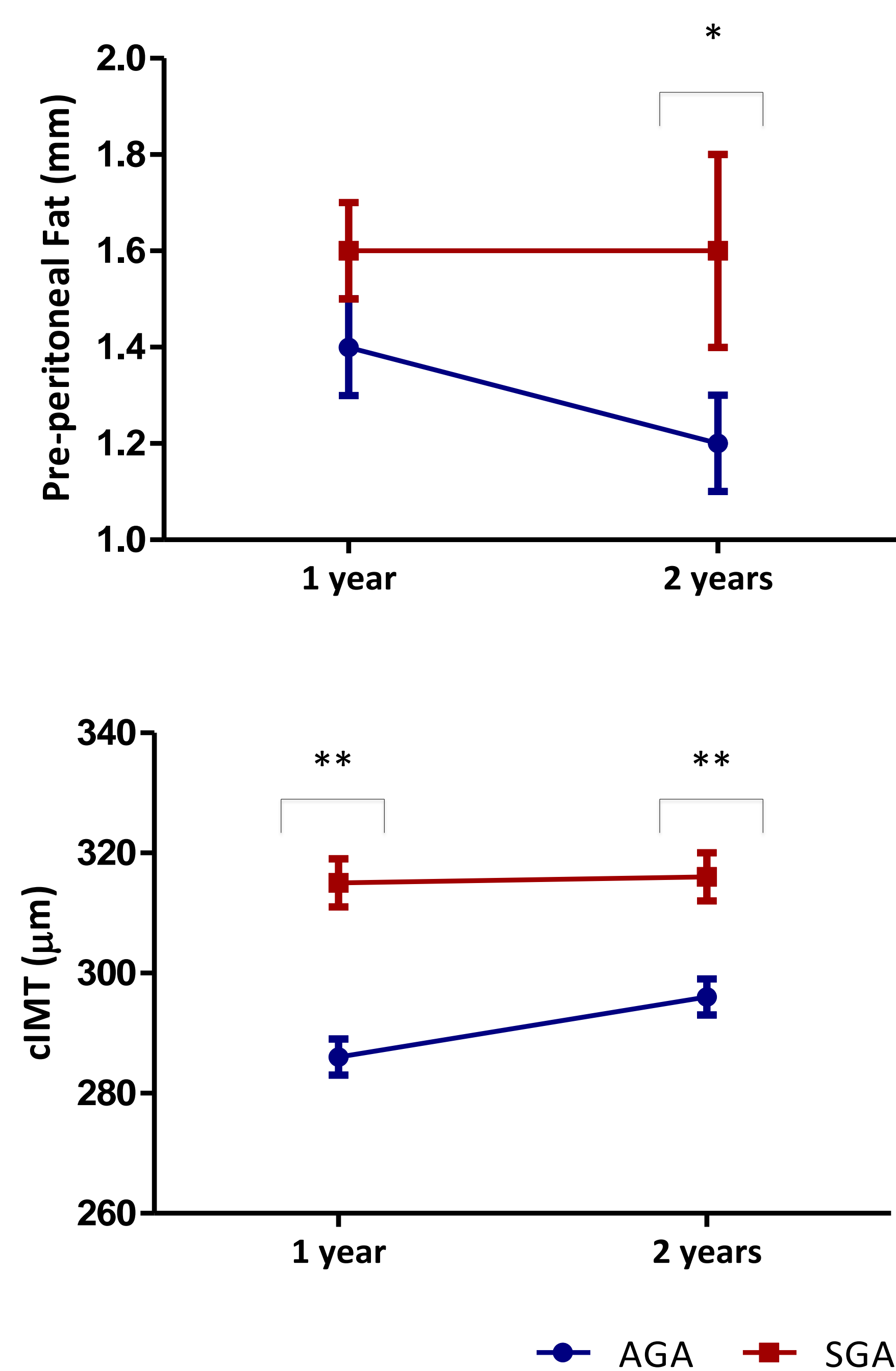
Values are mean ± SEM.

P values are adjusted for sex, gestational age, age and body mass index.

^a p<0.05; ^b p<0.01; ^c p<0.001 vs AGA.

HMW Adiponectin: high-molecular-weight adiponectin; H-FABP: Heart type fatty-acid binding protein; DXA, dual energy X-ray absorptiometry; BMC: bone mineral content; US: ultrasound; TAPSE: Tricuspid Annular Plane Systolic Excursion; Ratio E/A: peak velocity flow in early diastole (E wave)/ peak velocity flow in late diastole (A wave).

Figure. Longitudinal results of pre-peritoneal fat and cIMT in AGA and SGA infants at the age of 1 and 2 years.



*p<0.01; **p<0.001 for differences between subgroups.

Conclusion

From late infancy to onwards, term catch-up SGA infants have a thicker cIMT and more pre-peritoneal fat than AGA controls, but their cardiac morphology and function remain reassuringly similar.