Body composition in preterm and full-term infants 3 and 4 age old – preliminary data

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Introduction

Preterm born infants are at greater risk for the later development of obesity, hypertension and cardiovascular disease, and insulin resistance and type 2 diabetes than infants born full-term (1-4). Genetic and fetal epigenetic factors, as well as neonatal (or infant) programming related to weight gain or fat accumulation are unknown. Infants born preterm have more total fat mass in relation to lean body mass and increased visceral fat as a percentage of total body fat stores then term infants (1, 5-7). Obesity-related alterations in adipokine secretion are believed to play a causal role in the pathogenesis of the metabolic syndrome (7). The development of increased adiposity in general and of visceral adiposity in particular by term age may be significant contributors to the increased risk for later cardiometabolic sequelae in infants born preterm.

Aim

The aim of the study was to compare the body composition in preterm and full-term infants at age 3 and 4 years

Patients and methods

Total body bone mineral content (TBBMC, g), density (TBBMD, g/cm^2), and body composition (fat mass - FM, g; lean body mass - LBM, g) were measured using DXA (Prodigy, GE-Lunar, pediatric software) in 48 preterm infants (mean age: 3,12±0,54 years at V1 and 4,06±0,53 years at V2) and 24 full-term infants (mean age: 3,34±0,58 years at V1 and 4,32 ± 0,63 years at V2). Relative bone strength index was calculated as the TBBMC/LBM ratio. Serum levels of 25(OH)D, PTH, bone formation (OC, P1NP) and bone resorption (CTx) markers were determined by automatic chemiluminescent method. P3NP and NT-proCNP were measured in serum by radio- and enzyme-linked immunoassay, respectively. Mann-Whitney test was used for groups' comparisons.

Results

The anthropometric description of studied groups was showed in Table I. Body weight (BW) but not body height was lower in preterm in comparison with full-term infants at V1 (p=0.012) and V2 (p=0.004). Bone age was not significantly different between groups (Table I). Evaluation of body composition at V1 indicated that preterm infants have significantly higher body content of LBM (LBM/BW). At V2 full-term infants and preterm infants have comparable fat mass content (FM/BW) as well as bone mass to muscle mass index (TBBMC/LBM) (p=0.057 and p=0.158, respectively, Table II). On the contrary, preterm infants had higher muscle content in comparison to full term infants (LBM/BW – p=0.039; FM/LBM - p=0.044) as well as TBBMD (p=0.045). Relative bone strength index (TBBMC/LBM) was comparable in preterm and full term 4 years old infants (Table II). Serum biochemical indices of anthropometric and body composition parameters in 3 and 4 years old preterm and full-term infants were not significantly different (Table III). Only P3NP as indicator of muscle function was significantly higher in 3 years old preterm infants (p=0.004) (Table III).

Conclusions

Despite lower body weight, the body composition in 4 years old preterm infants was better than in children born at term due to the advantage of muscle mass and bone mineral density and proper relative bone strength index. It may indicate that the risk of bone and metabolic disorders are low in preterm infants at age 4 years.

Table II. Body composition of 3 and 4 years old preterm and full-term infants.

Parameter median (Q1-Q3)	Preterm infants	Full-term infants	*p*
3 years old			
LBM/BW (g/g)	**0.80 (0.75-0.85)**	**0.77 (0.74-0.80)**	**0.047**
4 years old			
TBBMD (g/cm^2)	**0.74 (0.69-0.76)**	**0.71 (0.70-0.73)**	**0.045**
FM (g)	**2348 (1636-2986)**	**3212 (2359-3617)**	**0.018**
LBM (g)	**12065 (11033-12677)**	**12840 (12374-13212)**	**0.016**
FM/LBM (g/g)	**0.17 (0.13-0.27)**	**0.23 (0.19-0.28)**	**0.044**
LBM/BW (g/g)	**0.81 (0.75-0.84)**	**0.77 (0.73-0.80)**	**0.039**
FM/BW (g/g)	0.14 (0.11-0.20)	0.18 (0.15-0.20)	NS (0.057)
TBBMC/LBM (g/g)	0.04 (0.04-0.04)	0.04 (0.04-0.04)	NS

Table I. Anthropometric variables of 3 and 4 years old preterm and full-term infants.

Parameter median (Q1-Q3)	3 years old			4 years old		
	Preterm infants	Full-term infants	*p*	Preterm infants	Full-term infants	*p*
Age (years)	3.1 (3.0-3.2)	3.0 (3.0-3.2)	NS	4.0 (3.9-4.1)	4.0 (4.0-4.1)	NS
Bone age (years)	3.5 (3.0-4.0)	3.0 (2.5-3.5)	NS	3.5 (3.5-4.0)	4.0 (3.5-4.2)	NS
Height (BH, cm)	96.0 (93.0-97.0)	97.0 (95.0-98.0)	NS	102.5 (98.0-105.0)	103.2 (102.0-106.0)	NS
Body weight (BW, kg)	**13.4 (12.0-15.0)**	**14.7 (14.0-15.5)**	**0.011**	**15.0 (14.0-16.5)**	**16.1 (15.7-18.0)**	**0.004**

Table III. Serum biochemical indices of anthropometric and body composition parameters in 3 and 4 years old preterm and full-term infants.

Parameter median (min-max)	3 years old			4 years old		
	Preterm infants	Full-term infants	*p*	Preterm infants	Full-term infants	*p*
25(OH)D (ng/ml)	25 (9-49)	21 (4-56)	NS	25 (12-42)	24 (10-38)	NS
PTH (pg/ml)	30 (15-62)	32 (16-45)	NS	30 (17-82)	35 (18-56)	NS (0.070)
IGF-I (ng/ml)	106 (40-278)	94 (46-154)	NS	109 (45-227)	103 (62-151)	NS
NT-proCNP (mmol/l)	14.3 (7.3-31.8)	14.3 (5.9-23.4)	NS	15.3 (0.6-26.5)	15.01 (6.7-21.2)	NS
P3NP (ng/ml)	**11.9 (7.5-20.3)**	**9.5 (7.0-16.9)**	**0.004**	10.3 (5.1-17.2)	9.5 (7.4-18.6)	NS
OC (ng/ml)	86 (54-161)	83 (46-176)	NS	87 (47-133)	85 (53-182)	NS
P1NP (ng/ml)	628 (429-1065)	592 (301-1032)	NS	544 (336-986)	541 (401-813)	NS
CTx (ng/ml)	1.18 (0.95-2.20)	1.32 (0.85-2.40)	NS	1.35 (0.97-2.09)	1.23 (0.80-2.04)	NS

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