

Metabolic profile of neonates with different duration of gestation and different size at birth

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Authors declare no conflict of interest

Introduction

Controversial findings about the metabolic profile in newborns depending on the length of gestation and size at birth have been reported.

There is evidence that birth weight can be a factor causing obesity later in life accompanied by metabolic complications. Production of adipokines, predominantly leptin and adiponectin as hormones produced by the adipose tissue takes place predominantly in the second trimester of pregnancy, playing a role in the lipid and glucose metabolism.

Aim

To analyze Insulinemia, adiponectin and leptin levels in children born prematurely and SGA neonates compared to term normal newborns.

Methods

196 healthy newborns were studied at the age 3-4 days. Birth weight (BW), birth length (BL), body mass index (BMI), ponderal index (PI), and BW/BL ratio were recorded at birth. Neonates were divided according to the length of gestation to term and preterm, and according to the size to: appropriate for gestational age (AGA), SGA and large for gestational age (LGA). Samples of blood were taken on the third day after delivery. Glycemia, insulinemia, cortisol, leptin and adiponectin were measured.

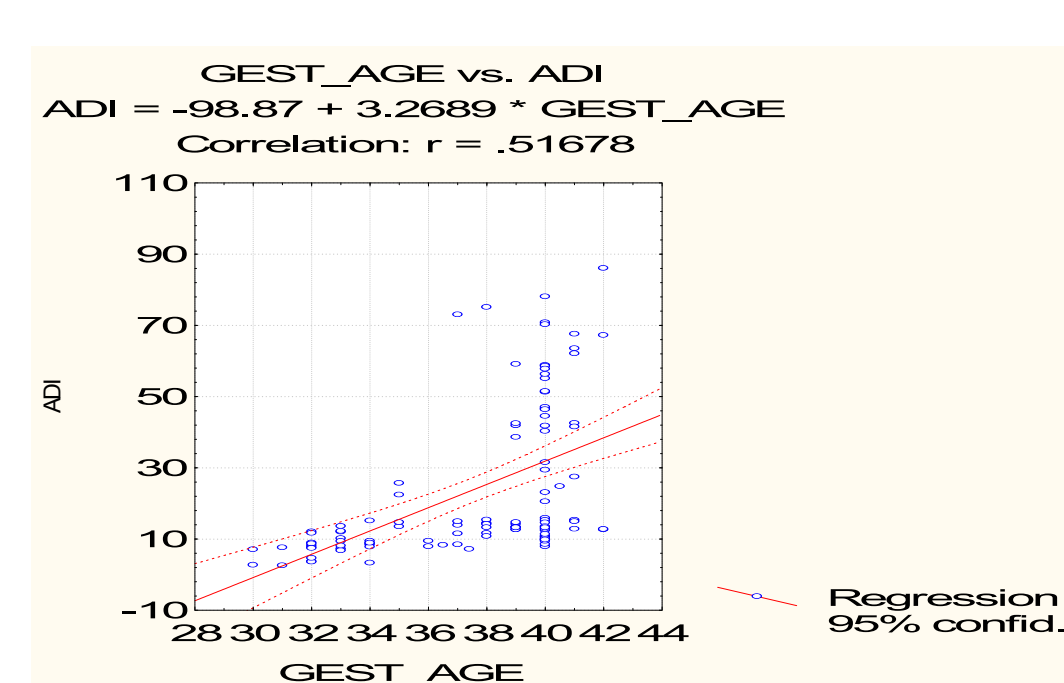
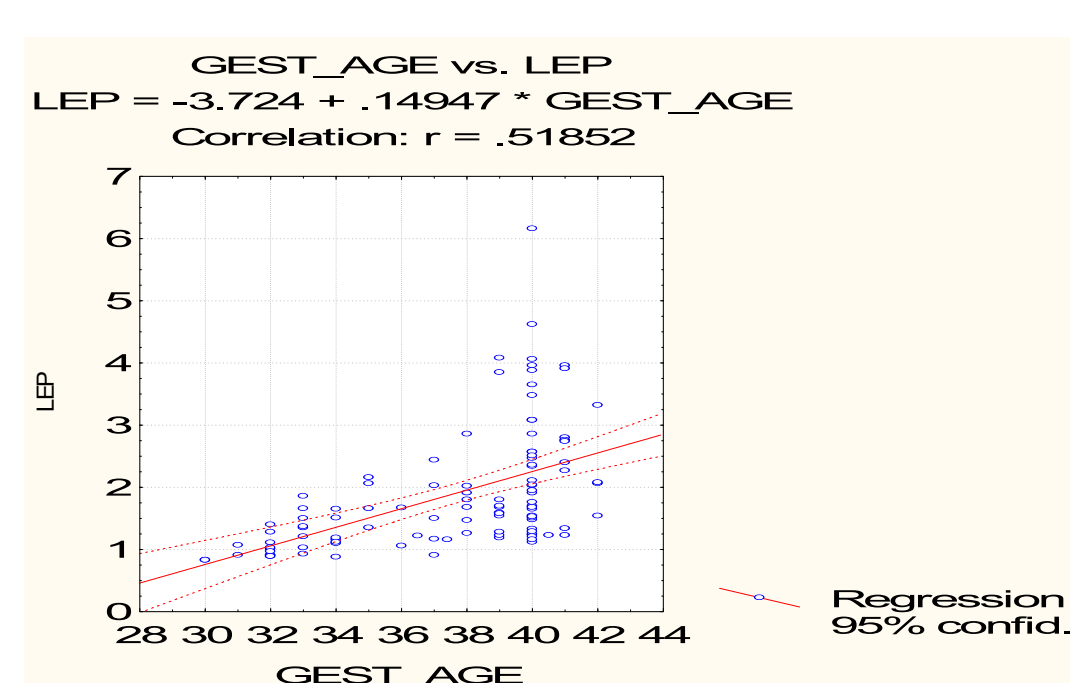
Results and Discussion

Insulinemia and C-peptide were highest in the group of term female newborns. However, HOMA index was highest in the SGA group. Leptin levels in term neonates were 2.12 ± 1.02 ng/mL versus 1.24 ± 0.35 in preterm, and 1.71 ± 0.53 in SGA neonates ($p < 0.001$). Levels of adiponectin were significantly higher in the term group; 30.77 ± 22.64 ng/ml versus 13.40 ± 1.70 in SGA ($p < 0.05$) and 9.43 ± 4.82 in preterm neonates ($p < 0.001$). Cortisol levels were also significantly different 167.55 ± 75.56 nmol/L in terms versus 135.54 ± 61.12 in preterm ($p < 0.01$), and 189.5 ± 64.7 ($p < 0.05$) in SGA neonates. SGA babies had higher leptin level ($p < 0.0002$) and adiponectin level ($p < 0.001$) compared to premature neonates.

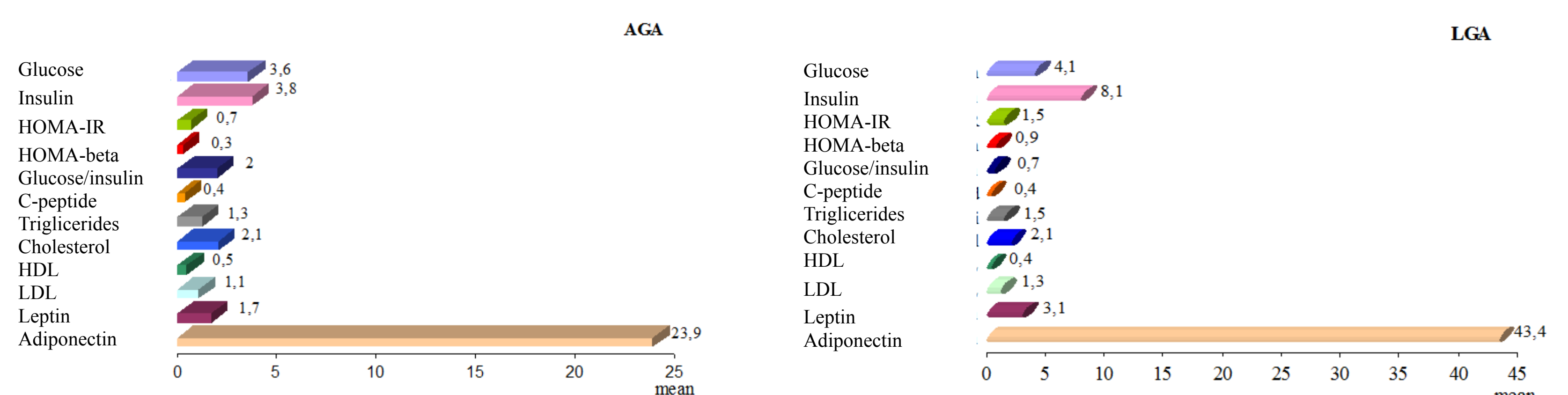
Table 1. Values of leptin, adiponectin and insulin

GA	Term		Preterm	
	AGA	SGA	AGA	SGA
BW				
Leptin (ng/mL)	$1.9 \pm 0.7^{a,b}$	1.7 ± 0.5^c	1.3 ± 0.4^a	$1.1 \pm 0.3^{b,c}$
Adiponectin (ng/mL)	$32.8 \pm 25.4^{a,b,c}$	12.7 ± 2.4^c	10.5 ± 5.5^a	7.4 ± 2.1^b
Insulin IU/mL	$3.78 \pm 2.79^{a,b}$	$5.74 \pm 2.99^{a,b,c}$	3.67 ± 3.09^c	$4.43 \pm 2.12^{b,c}$

^{a,b,c} Values with the same superscript in the same row are significantly different ($p < 0.01$)



Correlation of leptin and adiponectin levels with GA



	BW	Pearson-r	P
Leptin		0,6698	0,000
Adiponectin		0,7171	0,000
Glucose		-0,0258	0,719
Insulin		0,2293	0,001
HOMA-IR		0,1295	0,07
HOMA-beta		0,0211	0,769
Glucose/insulin ratio		-0,2084	0,003
C-peptide		0,3308	0,000
Triglyceride		-0,0498	0,488
Cholesterol		-0,1404	0,05

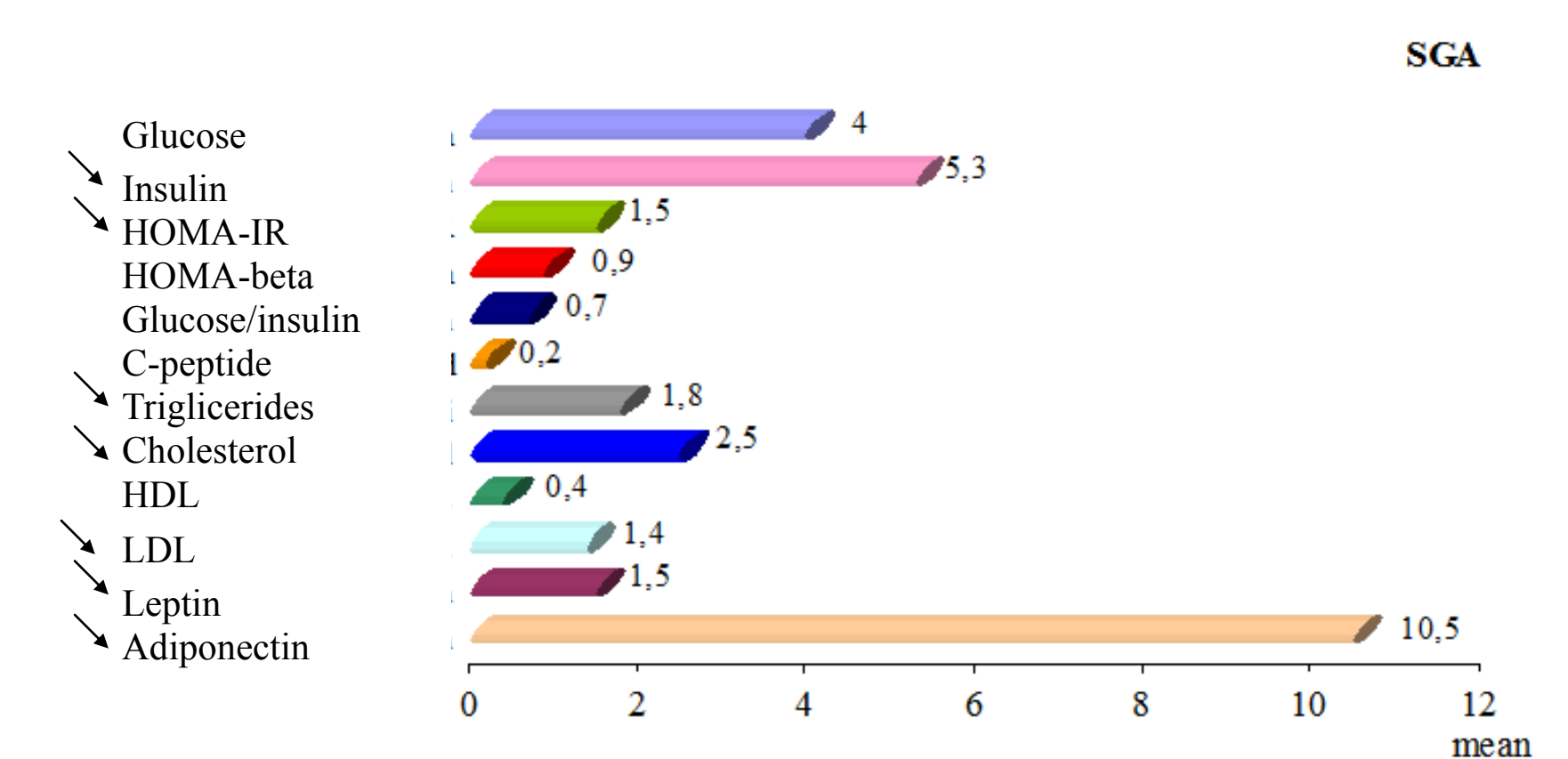
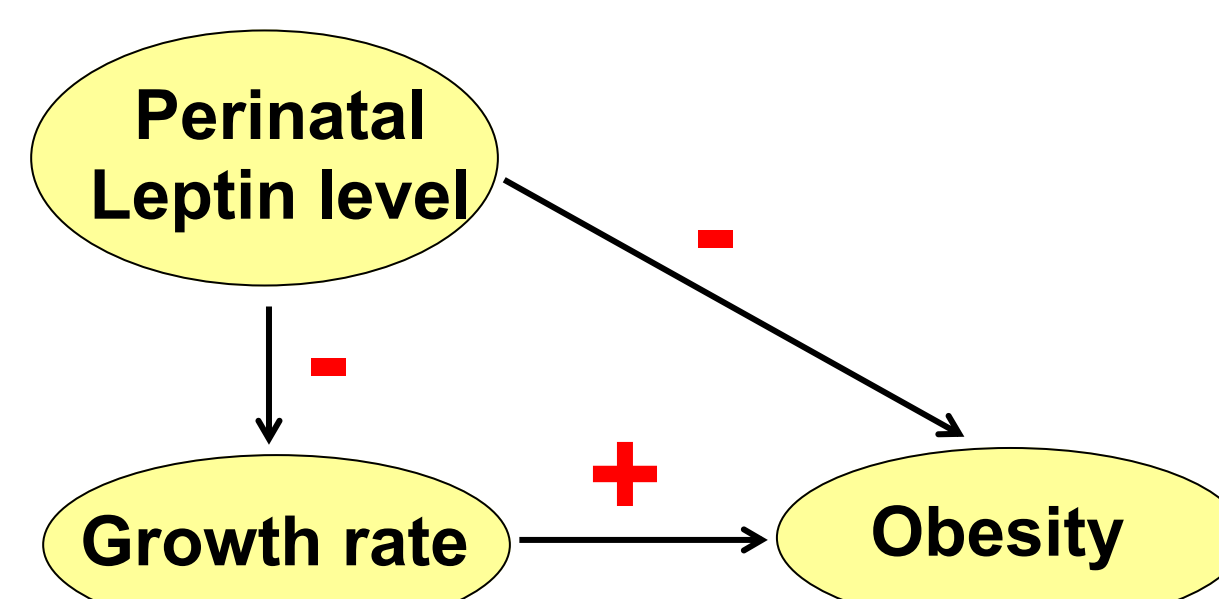


Table 2. Values of leptin, adiponectin and cortisol

	AGA	LGA	SGA
Leptin (ng/mL)	1.67 ± 0.66^a	$3.11 \pm 1.27^{a,b}$	1.48 ± 0.52^b
Adiponectin (ng/mL)	$23.87 \pm 12.72^{a,b}$	43.40 ± 16.98^a	10.55 ± 3.49^b
Cortisol (nmol/L)	150.68 ± 82.7^a	138.27 ± 63.45^b	$180.69 \pm 66.0^{a,b}$

^{a,b} Values with same superscript are significantly different ($p < 0.05$)



Foetal under nutrition and low birth weight progresses towards obesity later in life.

Foetal over nutrition and high birth weight are no favourable foetal programming events.

Both under nutrition and hyper nutrition during foetal life are associated with increased risk of type 2 diabetes later in life due mostly to insulin resistance.

Impaired neonatal leptin signalling and structural disorganization of hypothalamic feeding pathways are associated with leptin resistance in adulthood resulting in increased food intake, obesity and metabolic syndrome. Children born SGA who become obese during childhood are at a highest risk for insulin resistance and cardiovascular complications.

Conclusions

- The positive correlation between BW, BMI and PI and concentration of leptin and adiponectin is probably a result of increased production from the growing adipose tissue during the last trimester of pregnancy.
- Adipocytokines level depends on gestational age and ponderal index.
- Leptin and adiponectin levels are more likely to correlate with birth weight than with gestational age.
- Careful planning of nutrition of both premature and SGA neonates based on their metabolic profile might prevent obesity later in life.