

Concentrations of Leptin, C-Peptide and Insulin in Cord Blood as Fetal Origins of Insulin Resistance and Their Effect on the Birth Weight of the Newborn

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Abstract : Obesity is associated with an increased risk of developing insulin resistance. Insulin resistance often progresses to type-2 diabetes mellitus and is linked to a wide variety of other pathophysiological features including hypertension, hyperlipidemia, atherosclerosis (metabolic syndrome) and polycystic ovarian syndrome. Macrosomia is common in infants born to not only women with gestational diabetes mellitus but also non-diabetic obese women. During the past two decades, obesity in children and adolescents has risen significantly in Asian populations including Sri Lanka. There is increasing evidence to believe that infants who are born large for gestational age (LGA) are more likely to be obese in childhood. It is also established from previous studies that Asian populations have higher percentage body fat at a lower body mass index compared to Caucasians. High leptin levels in cord blood have been reported to correlate with fetal adiposity at birth. Previous studies have also shown that cord blood C-peptide and insulin levels are significantly and positively correlated with birth weight. Therefore, the objective of this preliminary study was to determine the relationship between parameters of fetal insulin resistance such as leptin, C-peptide and insulin and the birth weight of the newborn in a study population in Southern Sri Lanka. Umbilical cord blood was collected from 90 newborns and the concentration of insulin, leptin, and C-peptide were measured by ELISA technique. Birth weight, length, occipital frontal, chest, hip and calf circumferences of newborns were measured and characteristics of the mother such as age, height, weight before pregnancy and weight gain were collected. The relationship between insulin, leptin, C-peptide, and anthropometrics were assessed by Pearson's correlation while the Mann-Whitney U test was used to assess the differences in cord blood leptin, C-peptide, and insulin levels between groups. A significant difference ($p < 0.001$) was observed between the insulin levels of infants born LGA ($18.73 \pm 0.64 \mu\text{U/ml}$) and AGA ($13.08 \pm 0.43 \mu\text{U/ml}$). Consistently, A significant increase in concentration ($p < 0.001$) was observed in C-peptide levels of infants born LGA ($9.32 \pm 0.77 \text{ ng/ml}$) compared to AGA ($5.44 \pm 0.19 \text{ ng/ml}$). Cord blood leptin concentration of LGA infants ($12.67 \text{ ng/mL} \pm 1.62$) was significantly higher ($p < 0.001$) compared to the AGA infants ($7.10 \text{ ng/mL} \pm 0.97$). Significant positive correlations ($p < 0.05$) were observed among cord leptin levels and the birth weight, pre-pregnancy maternal weight and BMI between the infants of AGA and LGA. Consistently, a significant positive correlation ($p < 0.05$) was observed between the birth weight and the C peptide concentration. Significantly high concentrations of leptin, C-peptide and insulin levels in the cord blood of LGA infants suggest that they may be involved in regulating fetal growth. Although previous studies suggest comparatively high levels of body fat in the Asian population, values obtained in this study are not significantly different from values previously reported from Caucasian populations. According to this preliminary study, maternal pre-pregnancy BMI and weight may contribute as significant indicators of cord blood parameters of insulin resistance and possibly the birth weight of the newborn.

Keywords : large for gestational age, leptin, C-peptide, insulin

Conference Title : ICPO 2018 : International Conference on Pediatric Obesity

Conference Location : Melbourne, Australia

Conference Dates : February 01-02, 2018