SHORT REPORT

Plasma leptin, insulin, and neuropeptide Y concentrations in infants

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Changes in plasma leptin, insulin, and neuropeptide Y (NPY) concentrations were determined by radioimmunological methods in healthy infants. Compared with umbilical concentrations, on the 4th day of life plasma leptin and insulin were significantly decreased, and NPY was significantly increased. No correlation was observed between leptin, insulin, and NPY.

In mammals regulation of food intake and energy expenditure is modulated by the central nervous system through “adiposity signals”. The major adiposity signals identified are insulin and leptin, functioning as metabolic feedback signals to the hypothalamic arcuate nucleus, where they inhibit expression of neuropeptide Y (NPY), a potent stimulator of food intake, resulting in reduced food intake.¹ The correlation between leptin and insulin suggests that a functional “adipoinular axis” may exist at birth and that serum leptin may influence the “programming” of satiety and body metabolism.² At present, there are no data on the behaviour of NPY in newborn infants during the first days of life.

The aim of this study was to investigate cord plasma concentrations of NPY, and its postnatal changes, as well as changes in the pattern of leptin and insulin, in full term infants. Inter-relations between leptin, insulin, and NPY at birth and on the 4th day of life were also assessed.

SUBJECT AND METHODS

The study was approved by the local ethics committee, and the informed consent of the parents was obtained before participation.

We studied 30 healthy full term newborn infants vaginally delivered, after uncomplicated pregnancy, by normal, non-smoking mothers. All infants were exclusively breast fed.

Blood samples were drawn at birth from the umbilical cord and at the age of 4 days, after a three hour fast, from a superficial vein. Plasma was stored at -70°C until the time of the assays.

Plasma leptin and NPY concentrations were determined by radioimmunoassay (Euro-Diagnostica, Pantec, Arnhem, the Netherlands). The detection limit of the leptin assay is 0.24 ng/ml, and the intra-assay and interassay coefficients of variation are $< 5\%$ and 7% respectively. The detection limit of the NPY assay is 6 pmol/l, and the intra-assay and interassay coefficients of variation are 3.9% and 12.7% respectively. Insulin concentrations were determined by radioimmunoassay with a commercial kit (Schering Diagnostica).

The data are presented as mean (SD). Statistical evaluation was by paired Student's *t* test and Pearson's coefficient correlation. $p < 0.05$ was considered significant.

RESULTS

Table 1 gives mean (SD) plasma concentrations of leptin, insulin, and NPY at birth and on the 4th day of life. From birth to 4 days of age a significant decrease in leptin ($p < 0.05$) and insulin ($p < 0.003$) and a significant increase in NPY ($p < 0.05$) were observed. No correlation was found between leptin, insulin, and NPY at birth or on the 4th day of life ($p > 0.05$).

DISCUSSION

The neonatal period is a critical stage of development during which mammals have to start food intake, optimise energy intake to support growth and development, as well as maintain body temperature. The best documented function of leptin is the regulation of feeding and energy balance. In agreement with earlier reports,³ we found that plasma concentrations of leptin and insulin were higher in the cord blood than on the 4th day of life.

In humans, it has been shown that NPY is released into the circulation in response to sympathetic activation by a number of stimuli including hypoglycaemia, exercise, and acute stress.⁴ We show that plasma NPY concentrations on the 4th day of life are significantly higher than at birth, and are not correlated with plasma concentrations of leptin and insulin. This increase may result from enhanced neuronal release of NPY, in response to general activation of the sympathetic system present at birth,⁵ and/or from reduced clearance, but our study does not allow this conclusion. In any case, it has been shown that a rise in peripheral NPY may in itself exert central effects⁶ by directly interacting with NPY brain receptors located in the arcuate nucleus. These data may support the hypothesis that the increased plasma concentrations of NPY and the decreased plasma concentrations of insulin and leptin, found by us on the 4th day of life, may set up signals directed to initiate and increase neonatal feeding.

In conclusion, this study provides the first direct evidence that, in full term newborn infants, NPY, one of the most important derived neuropeptides mediating the effects of leptin on energy homeostasis, is present in cord blood and increases in the first days of life. Moreover, these data suggest that, at birth, in full term infants, some components of the complex system that regulates food intake and energy expenditure are developed and working.

Table 1 Plasma concentrations of leptin, insulin, and neuropeptide Y (NPY) at birth and on the 4th day of life in 30 healthy full term newborn infants

	Cord blood	4th day	p Value
Leptin (ng/ml)	9.58 (4.98)	4.91 (6.06)	< 0.05
Insulin ($\mu\text{IU/ml}$)	10.08 (6.35)	3.24 (1.32)	< 0.003
NPY (pmol/l)	44.47 (19.35)	74.25 (29.22)	< 0.05

Values are mean (SD).

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