Placental Lactogen

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Placental lactogen (PL) is a peptide hormone classified as a member of a growth hormone gene family. PL is secreted throughout pregnancy by both animal and human specialized endocrine cells. It is involved in the regulation of a range of gestational adaptations.

Keywords: placental lactogen ; chorionic somatotropin ; placenta

1. Introduction

Placental lactogen, also known as chorionic somatotropin, is a peptide hormone produced during pregnancy, in humans and other animals, by specialized endocrine cells.

More specifically, PL is synthesized by:

- syncytiotrophoblast cells in humans,
- trophoblast giant cells in rats and mice,
- and trophoblastic binucleate cells in cows and sheep [1][2][3][4][5][6].

PL is classified as a member of the somatotropin family, which also includes growth hormone (GH), prolactin (PRL), and placental growth hormone, mainly due to the similarities observed in their molecular structure [1][7][8][9]. More details about the PL family genes and encoded proteins have been described by Handwerger et al. in their excellent review [10]. In humans, PL mainly binds to prolactin receptors and with a much lower affinity to growth hormone receptors [10]. Moreover, specific PL receptors have been found in human fetal skeletal muscles [11]. Similar to humans, PL in ruminants binds with a high affinity to PRL receptors, but it also has a high affinity to GH receptors [7]. Mouse PL has a higher affinity to PRL receptors than GH receptors; however, in contrast to humans, in mice and rats, there are two types of active PL with distinct biological activity [9][12][13][14]. Due to the described differences, the results of studies performed in other species cannot be directly extrapolated to humans.

PL is detectable in both umbilical cord blood samples and maternal blood from the first trimester of physiological pregnancy, and its concentrations increase in the later stages of fetal and placental development [8][11][15]. Although the PL expression is only present in placental tissue cells, it is considered to play a significant role in the regulation of both maternal and fetal metabolic adaptations throughout the pregnancy [9][16]. The secretion of PL, as well as other placental hormones, could promote the state of systemic insulin resistance and subsequently be responsible for the elevation of maternal blood glucose levels to facilitate the supply of energetic substrates to the fetus [17][18][19].

2. Human Placental Lactogen (hPL)

hPL is believed to be involved in the regulation of both maternal and fetal gestational adaptation. However, the majority of hPL is released into the maternal circulation. To compartmentalize the hPL release into maternal and fetal circulation, Linnemann et al. used the dual in vitro perfusion of an isolated cotyledon, with hPL concentrations measured in the perfusates and the placental tissue prior to and after perfusion. According to their results, only 0.05% of hPL is transferred to the developing fetus, with the remaining percentage being released into the maternal circulation [20]. hPL is also detectable in the amniotic fluid. However, its concentrations are generally lower compared with the maternal serum [21]. In a group of term newborns (40th week), those born via vaginal delivery had significantly lower levels of hPL in both the umbilical vein and umbilical artery compared with those born through cesarean section [22]. hPL blood concentrations in multiple pregnancies tend to rise compared with single pregnancies [23].

Cases of pregnancy affected by metabolic conditions, including obesity and diabetes, are related to alterations in the hPL secretion pattern. Whereas obesity is most often associated with lower placental hPL expression, diabetes results in increased hPL blood levels [24][25][26]. Disruptions in hPL secretion are reported to be associated with an increased

prevalence of fetal growth abnormalities - growth retardation and fetal macrosomia [27][28].

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