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Distribution of magnesium in the human placenta membranes

Bio-elements are important constituents of the living organisms and it is their proper concentration and mutual proportions in the tissues that guarantee the correct development of these organisms. Pathologies caused by deficiency or excess of microelements often pose serious medical problems. Until recently researchers paid special attention to the optimum composition of macroelements in food. They are now beginning to look more closely at microelements, too, as being equally vital for keeping up good health. The influence of trace elements on metabolism and their physiological functioning are a good incentive for researchers to assay them in body fluids and tissues. Magnesium belongs to trace elements of a tremendous impact on the growth of a living individual (2). The key working mechanism of it consists in the role it plays in the structures of macromolecular compounds and in the activation of many enzymes. It is crucial for building up high-energy compounds (ATP, GTP) in a cell as well as for all processes utilizing those compounds. Therefore, such processes as glycolysis, biosynthesis of the lipids, nucleic acids and proteins, as well as the stabilization of membranes, the functioning of ion pumps, keeping up electrical potential in the nervous system and muscles – are only a few of the areas in which magnesium operates (2, 3, 5).

The objective of the present work was magnesium assay in the placenta membranes (the amniotic sac and the chorion).

MATERIAL AND METHODS

The membranes (chorion and amnion, n = 30) were collected after normal delivery of pregnancies between 37 and 41 weeks. Tissue samples were subjected to desiccation for 72 hours at 80°C, ashed at 450°C, and then dissolved in a concentrated HCl mixed with distilled water (1:1, v/v). The concentration of magnesium was determined by spectrophotometric method using atomic absorption spectrofotometer (Pye Unicam SP-192, UK),12. The results were statistically analyzed using Cohran-Cox test and assuming the differences as significant at the significance level of $p < 0.05$. The results are presented in the table.

RESULTS

Table 1 presents the level of magnesium in the chorion and in the amniotic sac. As follows from the numerical data presented in the table, the level of magnesium in the examined membranes of the placenta varies. The level of magnesium in the chorion is higher by 30% in comparison with the content of this microelement in the amniotic sac. Between the mean contents

of magnesium in the examined layers of the placenta there are no statistically significant differences.

Table 1. The level of magnesium (mg/kg of wet tissue mass) in the membranes of the placenta

Investigated parameter	Mean value X	Standard deviation s
Mg – amn.	37.85	19.17
Mg – ch.	50.26	15.67
Significance level	Mg – amniotic sac/Mg – chorion	r = 0.8

Mg – amn – level of magnesium in the amniotic sac, Mg – ch. – level of magnesium in the chorion

DISCUSSION

Magnesium is an extremely significant microelement in the body. Its functioning in the organism is multidirectional: by influencing the ion pumps it ensures proper transmission of nervous impulses in the nervous system and correct functioning of the muscular system. Magnesium also stimulates the immunological system (14, 15).

What follows from our studies is that magnesium is not evenly distributed, which may be due to differences in the metabolism of the membranes. The content of magnesium in a cell seems to be a result of the permeability of the plasmatic membranes of cells and the specificity of magnesium transport. Research has proved that the speed with which the exchange of magnesium ions takes place in the heart, liver and kidneys is higher than in the skeletal muscles, erythrocytes and the brain. An increased content of magnesium was found in rapidly proliferating cells, which indicates a probable correlation between the metabolic status of a cell and the velocity of magnesium transportation into and out of the cell (4, 7, 10).

The foetal metabolism depends on the substrates provided to it by mother's circulatory system. The placenta plays an important role in the proper development of the foetus. One of its most crucial functions is its participation in the exchange of substances both from mother to foetus and reversely. The foetus is an organism in which anabolic processes are prevalent. There is an active process of building-in of amino acids into proteins, fat production, synthesis and collecting glycogen. Energetic material passing through the placenta from mother's circulatory system to the foetus includes glucose, amino acids, fatty acids and ketone compounds (11).

The transport of glucose and amino acids is an active process which needs a lot of energy. The transfer of substances in the placenta takes place simultaneously in two directions – from mother to foetus and vice versa. The process is characterized by great dynamism. One of the kinds of transport is an active transport requiring energy supply. The foetus uses amino acids to build proteins, DNA and RNA. The concentration of amino acids in the serum is always higher in the foetal blood than in that of the mother's. It is indicated by the fact that there is an active transport of amino acids through the placenta from mother toward the foetus (13). Glycolisis in the foetal tissues is the main process leading to ATP emergence. What is more, when the foetus keeps growing, the process of glukonogenesis accelerates (8, 9). All the above mentioned processes require energy supply in the production of which magnesium play an active role (1).

While there are few literature sources with the data concerning the influence of hormones, we cannot exclude the existence of hormonal influence on the regulation of the level of magnesium and the activity of the enzymes (9). Insulin injections cause increased magnesium intake in some tissues including muscles and heart. Insulin-induced transport of magnesium to the cells may be a factor responsible for the decrease of magnesium concentration in the blood serum noticed during insulin therapy in diabetic ketoacidosis (4, 6, 7, 10)

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SUMMARY

In this work we tried to estimate the level of magnesium in the membranes of the placenta. The object of the studies referred to the sections of placenta membranes: the amniotic sac and the chorion taken from healthy women patients in labour between 37^{th} and 41^{th} weeks of pregnancy. The content of magnesium was assayed using atomic absorption spectrometry. An increased magnesium level in the chorion indicates faster metabolism in this layer of membrane.

Rozmieszczenie magnezu w błonach łożyska ludzkiego

W pracy oznaczono rozmieszczenie magnezu w błonach łożyska ludzkiego. Materiał do badań stanowiły błony łożyska ludzkiego – kosmówka oraz owodnia, pobierane od zdrowych rodzących pomiędzy 37 a 41 tygodniem ciąży. Stężenie magnezu oznaczano za pomocą absorpcyjnej spektrofotometrii atomowej (ASA). Wyższe stężenie magnezu w kosmówce wskazuje na wzmożone procesy metaboliczne w tej warstwie łożyska.