The Direct Measurement of Serum Zinc in Pregnant Women and Its Correlation to Alkaline Phosphatase

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ABSTRACT

Zinc is recognized as essential for the activity of a wide range of enzymes. The first demonstration that zinc had a special biological function in relation to enzyme function, came with the discovery that carbonic Anhydrase contained significant amount of zinc which appeared to be required for normal activity. Alkaline phosphatase is a zinc-metalloenzyme that requires magnesium for activity and specific dietary deficiencies of either Zn or Mg, have been found to lower the alkaline phosphatase activity in serum. We took into consideration 100 cases of pregnant women, divided into groups according to fetus age, maternal age, zinc measurements, ALP activity etc. We measured serum zinc directly using by Atomic Absorption Spectrometry (VARIAN AAS-220) and at the same time alkaline phosphatase activity by a rapid method using p-nitrophenyl phosphate. The data was analyzed to see if there was any positive correlation between serum zinc and alkaline phosphatase activity in all diseases: Preterm delivery, preeclampsia, anemia, cephalic, anomalies. As a conclusion, the statistical evaluation showed that there was a negative correlation between serum zinc and alkaline phosphatase activity in patients suffering from preeclampsia, whereas a positive correlation in diagnosis such as: preterm delivery, anemia, cephalic and anomalies.

Keywords: zinc in pregnancy, zinc and ALP, ALP and pregnancy, pregnancy complications.

INTRODUCTION

Pregnant women are often prescribed to take prenatal multivitamins, especially those with a high dose of iron necessary for fetus’ growth. But the thing is, the multivitamins should also contain zinc in high amounts. Most of the prenatal multivitamins don’t contain zinc which is important during the growth and development of the fetus. Pregnant women know that good nutrition is important for a healthy pregnancy, but it's not always clear exactly why your body needs certain nutrients. Zinc, iron and protein are all essential for nourishing the growth of cells and tissues, which occur throughout pregnancy, and you can make sure you're getting the nutrition your body needs by eating a balanced and nutrient-rich diet (2, 3). A balanced diet provides all of the main food types that are required for both mother and baby during pregnancy. The main food groups are proteins, fats and carbohydrates.

Zinc is recognized as essential for the activity of a wide range of enzymes, including alkaline phosphatase, alcohol dehydrogenase, carboxypeptidase A etc. The first demonstration that zinc had a special biological function in relation to enzyme function, came with the discovery that Carbonic Anhydrase, contained significant amount of zinc which appeared to be required for normal activity (1). Alkaline Phosphatases are a group of enzymes found primarily in the liver (isoenzyme ALP-1) and in the bones (isoenzyme ALP-2). The primary importance of measuring alkaline phosphatase is to check the possibility of bone disease or liver disease. Thus the serum alkaline phosphatase is a measure of the integrity of the hepatobiliary system and the flow of bile into the small intestine. ALP is physiologically produced by placenta. It appears in maternal serum between the 15th and the 26th week of pregnancy and increases during the third trimester. A decreased serum alkaline phosphatase may be due to: Zinc deficiency, Hypothyroidism, Malnutrition with low protein assimilation, anemia etc. An increased serum Alkaline Phosphatase may
be due to: Oral contraceptives, Obstructive pancreatitis, Hepatitis/Mononucleosis/CMV, Congestive heart failure, Parasites etc.

MATERIAL AND METHODS

The experimental study consisted of 100 pregnant women, which were divided into groups as follows:

According to fetus age:
- 3 women in first trimester
- 19 women in second trimester
- 78 women in third trimester

According to maternal age:
- 5 women < 20 years old
- 67 women 20-30 years old
- 28 women >30 years old

According to zinc measurements:
- 64 cases were anemic
- 36 cases were normal

According to alkaline phosphatase (ALP) determination:
- 20 cases with low ALP levels
- 65 cases with normal ALP levels
- 15 cases with high ALP levels

According to maternal diagnosis:
- 34 cases were cephalic
- 14 cases with anomalies
- 5 cases with anemia
- 13 cases with preeclampsia
- 12 cases premature delivery
- 2 cases hyperemesis
- 2 cases with diabetes
- 2 cases abortion
- 2 cases illegal
- 3 cases membrane ruptures
- 3 manual rupture
- 3 cases breech delivery
- 1 case with fetal hypotrophy
- 1 case placenta previa
- 2 cases twin pregnancy
- 1 case baby death

The techniques used for the determination of serum zinc, included Colorimetry, Polarography, X-ray fluorescence, Fluorometry and Atomic Absorption Spectroscopy (AAS). AAS techniques are preferred in the clinical laboratory, because of their specificity, sensitivity, precision, simplicity, and relatively low cost per analysis. (4)

The direct dilution method presented here requires less than 2 min per sample. We used Glycerol as a solvent for the standards, and it also serves as an ideal additive for adjusting the viscosity and flow rate of the standards. We took 2 ml blood from each pregnant woman and serum zinc level was measured directly by using Atomic Absorption Spectrometry (VARIAN AAS-220), at the same time we
measured alkaline phosphatase level by a rapid method using a new substrate (p-nitrophenyl phosphate).

Pregnant women having zinc concentration less than 70 mcg/dl were marked as zinc deficient patients, whereas those having zinc levels 70-114 mcg/dl were marked as normal patients.

Pregnant women having ALP levels 100-290 mcg/dl were marked as normal patients. Lowered ALP levels are due to anemia, Wilson’s disease, Hypophosphatasia, an autosomal recessive disease, Chronic myelogenous leukemia, etc. ALP levels are significantly higher in pregnant women because placenta produces ALP. Also, elevated ALP could happen in the case of Paget's bone disease, or in people with untreated Celiac Disease.

RESULTS AND DISCUSSION

A number of studies have indicated that changes in the concentration of zinc in tissues, follow the course of some diseases such as diabetes, chronic renal failure, according to the relationship between zinc and alkaline phosphatase and the effect of the diseases mentioned above. The data were analyzed to see if there was any positive correlation between serum zinc and alkaline phosphatase activity in all diseases: Preterm delivery, preeclampsia, anemia, cephalic, anomalies. The statistical evaluation showed that, there was not always a positive correlation between serum zinc and alkaline phosphatase activity (Figure 1).
Figure 1: The correlation of serum zinc and alkaline phosphatase activity in preterm delivery, preeclampsia, anemia, cephalic and anomalies.

CONCLUSIONS

- Data showed that ALP levels increased during pregnancy, because placenta produces ALP.

- According to the 100 cases taken into consideration, there was a negative correlation between serum zinc and alkaline phosphatase activity in patients suffering from preeclampsia, whereas a positive correlation preterm delivery, anemia, cephalic and anomalies.

- There were in total 100 pregnant women, from which 64 cases were anemic and 36 cases were normal with serum zinc levels lower than 70mcg/dl.

- 20 of 100 cases had a low ALP level, who were considered as patients suffering from anemia or Wilson’s disease; 65 cases had normal ALP level, who were considered as normal pregnant women; whereas 15 cases who had high ALP levels, were considered as patients suffering from Paget's disease of bone etc.

REFERENCES