

COMPARISON OF MATERNAL ZINC LEVEL IN TERM PREGNANCY ASSOCIATED WITH PREMATURE RUPTURE OF MEMBRANES IN NORMAL PREGNANCY

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ABSTRACT

The purpose of this study was to determine maternal zinc levels, whether there is any difference between term pregnancy associated with premature rupture of membranes and normal pregnancy. This was an analytic observational study using comparative, cross sectional design. Sample comprised 40 mothers with term pregnancy and vaginal birth at Dr. Soetomo Hospital, consisting of 20 term pregnancy with premature rupture of membranes (PROM) and 20 term pregnancy without complications. We used venous blood specimens, colostrum and head hair. Specimens were prepared to be homogeneous solution for analysis. Levels of zinc in the specimen were determined using Atomic absorption Spectrophotometry. Blood zinc levels in term pregnancy with PROM (4.33 ± 1.21 ppm) were significantly lower than in term normal pregnancy (5.20 ± 1.33 ppm), with $p = 0.036$. Zinc content of colostrum (5.86 ± 3.51 ppm vs 6.95 ± 3.77 ppm) and head hair (254.85 ± 167.45 ppm vs 348.78 ± 228.17 ppm) was not significantly different from the second group ($p > 0.05$). In conclusion, blood zinc levels in term pregnancy with PROM was lower than that in normal pregnancy. Hair zinc concentration of colostrum and the head did not differ between the two groups.

Keywords: maternal zinc status, premature rupture of membranes (PROM), term pregnancy

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INTRODUCTION

Premature rupture of membranes (PROM), the rupture of membranes before the onset of labor, is one obstetric problem, because it increases the risk of infection in the mother and fetus, as well as morbidity and mortality in infants. PROM incidence varies between 5-15% of all pregnancies. About three-quarters of which occurred at 37 weeks gestation or more, and the rest occurred at gestational age less than 37 weeks (preterm pregnancy), which is the cause of 20-50% preterm birth (French 1996, ACOG 2007).

Causes of premature rupture of membranes so far can not be known for certain. The underlying pathogenesis is still not fully understood. The hypothesis proposed states that PROM has occurred from a lot of groove sides (multifaced) and many steps (multistep), which involves an abnormal relationship between the hosts - the reproductive tract and genital microflora. Lack of understanding of the causes and pathophysiology of PROM cause failure in making preventative measures against this complication (French 1996, Parry 1998, Parsons 1999).

In terms of hosts, some authors suggested that deficiency of some trace elements/certain minerals on

pregnant women, particularly the element zinc, had a role in the pathogenesis of PROM. Zinc is an essential element for the process of maternal and fetal metabolism during pregnancy. Element zinc is required for the preparation of structure and function of various enzymes, including enzymes MMP (matrix metalloproteinase), DNA and RNA polymerase, as well as having an important role to stabilize biomembrane. Zinc also causes the antibacterial properties of amniotic fluid, so that with the decrease in maternal zinc status during pregnancy can also result in decreased availability of zinc to the fetus and placenta, then to affect the extracellular matrix restructuring process that is underway in amnionchorion membranes and lead to weakening of the strength and integrity of the membrane membranes and ultimately more likely to occur PROM (Athayde 1998, Chvapil 1973, Kiilhomma 1984).

Determination of zinc nutritional status derived from the measurement of zinc content of blood, hair, and colostrum. Because zinc mainly located in the cell, the levels of serum zinc content of only a small reflection of this mineral. Moreover, serum zinc concentration is influenced by several factors, including diet, stress, albumin levels, and metabolic status than whole blood zinc levels (whole blood) (Aggett 1985, Prasad 1985).

Levels of zinc in hair provide useful information related to zinc homeostasis, because the typical characteristics of hair formation, which is biological material, can reflect the status of zinc in the past. Levels of zinc in colostrum (breast milk) reflects the body's ability to mobilize zinc and the consequent benefits to the measurement of maternal zinc index (Prasad 1985, Contiro 1994, Turan 2001). This study reveals differences in maternal zinc levels in just months of pregnancy complications involving premature rupture of membranes compared with normal pregnancies (without premature rupture of membranes).

MATERIALS AND METHODS

This was an observational study of comparative analytic "cross sectional", to assess and compare the zinc status of pregnant women in labor with term infants and premature rupture of membranes without complications. The study was conducted at room maternity hospitals. Dr. Soetomo. The study population was pregnant women who came to place the study meet the following inclusion criteria: patients diagnosed with premature rupture of membranes, is willing to follow the research procedure, gestational age ≥ 37 and ≤ 42 weeks based on the calculation of the first day of last menstruation or examination by ultrasonography, singleton pregnancies, fetal life, head presentation, no chief pelvic disproportion. Exclusion criteria included hidramnion, korioamnion infection, abnormal anatomy or the presence of tumor of the uterus, no pregnancy complications, such as diabetes mellitus, hypertension in pregnancy, heart disease, antepartum hemorrhage, history of abdominal trauma, history of cervical surgery, the mother is smoking. While the control group were pregnant women who delivered normal term infants (gestational age ≥ 37 - ≤ 42 weeks) without the complications of premature rupture of membranes.

Maternal zinc levels determined from whole blood (whole blood), colostrum and head hair. Whole blood was taken from cubital vein by 5 ml, collected in bottles that had been given anticoagulant EDTA (1.0 to 1.5 mg/ml). Hair is taken from the occipital along the strands of hair using scissors as much as 1 gram. Colostrum is collected manually on day 2-4 after delivery as much as 10-20 ml, stored in a dark bottle and added a solution of formalin 1% of 1ml. The specimen is then sent to the Surabaya Regional Health Laboratory to be processed and zinc levels were measured from each specimen with an atomic absorption spectrophotometer method (Atomic absorption Spectrophotometry) (Nendrosuwito 1999, Sugiharto 2001). From the calculation, the total sample

size = 25.8 rounded to 26. In this study planned sample size of each group is 20.

RESULTS

Table 1. Characteristics of patients.

	Premature Rupture	Normal Pregnancy	Statistical Test
Age (years)	29.50 \pm 6.39	28.05 \pm 5.03	NS
Gravidity	1.85 \pm 1.42	2.00 \pm 0.97	NS
Parity	0.60 \pm 1.19	0.90 \pm 0.85	NS
Pregnancy age (weeks)	39.17 \pm 1.35	39.05 \pm 1.15	NS

NS = non significant

Table 2. Levels of maternal zinc (in units of ppm).

Zinc level (ppm)	Premature Rupture (x \pm SD)	Normal Pregnancy (x \pm SD)	Statistical Test
Blood	4.33 \pm 1.21	5.20 \pm 1.33	p= 0.036 (S)
Colostrum	5.86 \pm 3.51	6.95 \pm 3.77	p= 0.349 (NS)
Hair	254.85 \pm 167.45	348.78 \pm 228.17	p= 0.146 (NS)

S = significant, NS = non significant.

DISCUSSION

Results of analysis of zinc concentration for all specimens, both blood, colostrum and head hair to PROM group has an average rating lower than the control group. With the t test for 2 independent samples only from the measurement of blood samples that had significant differences ($p = 0.036$). As for the determination of zinc levels in colostrum and head hair found that the result non-significant difference for the PROM and the control group (normal pregnancy). In the physiological state of fetal membrane rupture at the moment of delivery. Premature rupture of membranes occurs when these membranes rupture before there are signs of early labor. The underlying cause is still a hypothesis (French 1996). As a result of a lesion, the amniotic membrane and decidua nearby will respond by producing mediators such as cytokines, prostaglandins and protein hormone which in turn is followed by activation of enzymes that degrade extracellular matrix has capability which is a network buffer in the amniotic membrane (Athayde 1998, Nagase 1999).

Matrix metalloproteinase is a class of zinc-enzymes that have the ability to degrade extracellular matrix

components such as collagen and proteoglycans in normal embryogenesis and remodeling and also play a role in a number of disease processes. This enzyme is secreted in the form of pro-enzymes. Latent period of this enzyme due to binding zinc cystein with the "active center" which makes the enzyme was stable in the form of "inactive". Activation of this enzyme by various mediators must be preceded by the separation cystein chain of zinc ions (Cystein switch) (Nagase 1999). MMP activity is regulated by an endogenous regulator of tissue inhibitor of matrix metalloproteinase (TIMMP). The strength and integrity of the amniotic membrane is determined by the balance between the degradation and remodeling by MMP. On the eve of this balance is shifting toward labor matrix extracellular degradation and lead to weakening of the strength and integrity of the membranes (French 1999, Nagase 1999).

Decrease in maternal zinc status would lead to decreased tissue zinc content. The role of zinc as a factor involved in etiopatogenesis PROM, demonstrated that low levels of zinc will cause malproduction of essential proteins, induction of cell death, disruption of cell-mediated response (in which zinc plays an important role as an antimicrobial and antiviral in amniotic fluid), causing contraction that is not normal, reducing the number of Gab-junction in animal studies, interference with the synthesis of prostaglandins and increase the sensitivity of female genitalia tract infection (French 1999, Villa 1985, Wellingshausen 2001). Maternal zinc levels are sub-normal will affect the level of susceptibility to infection or inflammatory process, also will cause the availability of zinc to the fetus and placenta to be reduced. This can disrupt the process of reconstruction and remodeling in progress. Degradation of extracellular matrix in fetal membranes will weaken the strength and integrity of the amniotic membranes (Parry 1998, Sikorski 1990). Sikorski et al (1990) which proves the existence of differences between maternal zinc status on PROM is lower than the control group ($p = 0.0002$). Moderate research by Kiilhoma et al (1984) found no significant difference between serum zinc levels in aterm PROM with the control group. Kiilhoma concluded that low levels of zinc which will take effect on preterm birth rather than at birth just months.

From the results of this study indicate that the average concentrations of zinc in specimens of blood, colostrum and head hair were lower in pregnant women with premature rupture of membranes compared with delivery without premature rupture of membranes. However, if this difference is statistically test with independent samples t test, the only significant difference was found in blood specimens. The mean

whole blood zinc levels (whole blood) PROM group (4.33 ± 1.21 ppm), control group (5.20 ± 1.33 ppm), ($p = 0.036$).

Hair zinc concentration of colostrum and the head did not differ significantly between the two groups ($p > 0.05$). This can be explained that the levels of zinc in colostrum greatly influenced the current diet, weight gain during pregnancy, social status, while making and others. This condition is more representative of the body's ability to mobilize zinc from zinc to reflect the current status (Sikorski 1990, Wood 2000). Hair zinc levels do not reflect the current status of zinc, because its turnover is slow to reflect the status of zinc in the past. Factor of age, gender, hair color, location also affects the zinc content of hair. Some researchers use the hair of the head, while others mentioned using pubic hair. This raises the idea that hair zinc levels are not homogeneous. Moreover, in this study were taken along the strands of hair, so the interpretation of the results of his analysis of zinc levels do not reflect the zinc status at the time of the commencement of the process of premature rupture of membranes (Contiro 1994, WHO 1996).

CONCLUSION

Zinc levels in the blood was lower in the months of pregnancy is accompanied by premature rupture of membranes compared with normal pregnancy. There were no significant differences in zinc levels in the colostrum and the head of hair in just months of pregnancy accompanied by premature rupture of membranes and normal pregnancy.

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