ESSENTIAL METAL STATUS DURING PRE-TERM LABOUR

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SUMMARY

Blood samples of 130 patients were analysed for magnesium, zinc and calcium. Trace elements status were determined in blood of patients going into labour during 20-37 weeks of gestation. The results indicate a significant fall in blood magnesium levels during preterm labour of 29-37 weeks compared to respective control. The serum zinc concentration also showed steep fall in both groups of 20-28 weeks and 29-37 weeks of preterm labour cases as compared to their control level of blood calcium decreased significantly in case of preterm labour between 29-37 wks of gestation but there was only marginal depletion in cases of 20-28 wks of gestation. The results further indicate that preterm labour is more frequent among socio-economic backward population and to a lesser extent in cases of high parity and when the essential metal concentration drops below critical level it may induce premature onset of labour.

INTRODUCTION

The role of nutrition and its effect on maternal health and preterm labour has been the subject of study and controversy. Various studies conducted have confirmed the influence of nutrition both macro nutrients and micro nutrients on pregnancy outcome. Most recent studies have addressed the issues of effect of minerals and trace elements on Pre-term labour. The importance of calcium, magnesium and zinc in diet of pregnant women has been well established and has been subject of several reviews (Pitken 1985) Pregnancy is a time of increased calcium demand because the developing fetus, by term will have deposited 30 gm of calcium in its own skeleton. Most of

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this deposition occurs during last 10 weeks of pregnancy (Pitken 1985). The cardinal feature of calcium metabolism in the fetus is the active placental transport of large quantities of calcium, whereas parathyroid hormone and calcitonin do not cross the placenta theoretically. The resultant fetal hypercalcemia should suppress the fetal parathyroid and / or stimulate fetal calcitonin release. In general pregnancy is a time of both enhanced calcium absorption from the gut (Belizan et al 1988) and physiologic calciuria. There have been clear evidences which has lead to the recognition of importance of dietary calcium during pregnancy (Christiansen et al 1976)

Zinc is an essential element for many metabolic pathway. Zinc deficiency in experimental animal has been associated with reduced fertility (Apgar 1970), fetal neurological malformation and growth retardation in the late pregnancy. Zinc is also essential for normal human reproduction. It has a role in oxidative metabolism, DNA and RNA synthesis, immuno competence and membrane stabilization. Given the extensive role of zinc in many enzymes and the well documented adverse effects of zinc deficiency in pregnant animals, its role in human pregnancy would also be expected to be wide. Magnesium is a divalent cation has an important physiological effect. It is an inhibitor of smooth muscle contraction. Clinical evidences of the inhibition came from the use of magnesium sulphate for the treatment of pre-eclampsia which frequently decreased uterine activity as a side effect. In recent years several reports have demonstrated the efficacy of magnesium infusion inhibitory uterine activity. Charles et al (1977) recommended supplementation of magnesium sulphate should be started in patients who are in premature labour as early as possible.

The above studies clearly indicate a definite role of calcium, zinc and magnesium during preterm labour. The present study was thus planned, to determine their status in women going into labour before completing 37 weeks of gestation.

MATERIALS AND METHODS

The study was undertaken in 130 subjects selected from antenatal clinic, out patient department, indoor department and labour room of Kamla Raja Hospital, Gwalior during the period April 1992 to April 1993. All preterm patients between gestational age of 20-37 weeks of pregnancy were screened for their eligibility. They were divided into two groups of 20-28 wks and 29-37 wks. Normal pregnant patients of the same gestational age were also included in the study. Patients between gestational ages of 38-42 weeks of pregnancy served as pregnant control and non pregnant healthy patients were taken as control. A detailed history particularly the age, gravida, parity, per capita income and LMP was taken. General, systemic and obsteteric examination were done. Patients with acute medical or surgical illness, any complication of pregnancy,haemorrhage, cervical incompetence, positive history of STD or VDRL and patients of Rh incompatibility were not included in the study.

5 ml of venous blood was drawn and collected in heparinized vial. Zinc, magnesium and calcium concentration was

measured following wet acid digestion using an atomic absorption spectrophotometer (AAS).

STATISTICAL ANALYSES

Data was compared for statistical analysis by following one way analysis of variance followed by Dunnett's t test.

RESULTS

Table 1 indicates the concentration of blood magnesium, calcium and zinc in cases of normal pregnancy and pre-term labour. There was a significant fall in blood magnesium, zinc and calcium level in cases of pre-term labour particularly between 29-37 weeks. Interestingly, a marginal increase in calcium level and a decrease in blood zinc level was noticed in cases of normal pregnancy between the period of 20-28 weeks of pregnancy. The level however, became normal in the later part (29-37 weeks of pregnancy).

Table 2 indicates the level of blood magnesium, calcium and zinc during the pre term labour in subjects of different age group. The levels of two essential elements eg. magnesium and calcium decreased sharply in patients of 20-28 weeks particularly in the subjects of 15-22 year of age. There was only marginal decline in blood zinc level in the age group of 29 year and above. The cases of pre-term labour between 29-37 weeks showed an interesting patern. There was a sharp decline in blood magnesium and calcium level in subjects of all the three age group. However, blood zinc concentration rose significantly particularly in the pre-term subjects of 29-37 weeks of 15-22 year and 29 above age group.

Table I

Blood magnesium, zinc and calcium concentration during normal and preterm labour

Subject	Period of pregnancy	Number of subject	%	Blood, ug/ml magnesium	calcium	zinc
Normal pregnancy	38-40	17	14.0	16.41±1.22*	95.21±1.73*	11.53±0.74*
Normal pregnancy	20-28	19	15.7	16.42±1.13*	108.23±4.52	9.50±0.13
Normal pregnancy	29-37	20	16.5	18.31±0.76*	94.81±1.73*	12.55±0.68*
Pre term labour	20-28	20	12.4	16.23±1.17*	91.62±4.52*	7.89±0.73
Pre term labour	29-37	40	28.9	11.02±0.65	84.72±3.83	8.75±0.45
Non pregnant	-	15	12.4	17.23±4.01	115.92±2.56	12.09±14.9*

* Values are mean ± SE : Means with matching symbols notation within the same column are not different at 5% level of significance.

Table II

Blood magnesium, zinc and calcium concentration in preterm labour cases of different age groups

Subject	Age years	Number of cases	%	Blood ug/ml magnesium	calcium	zinc
Pre-term labour (20-28 weeks)	15-22	5	31.3	19.27±0.40	103.17±10.91	7.87±0.46
	23-28	10	31.3	13.73±0.43	79.73±5.05	8.53±1.59
	29 and above	5	31.3	16.52±0.47	88.72±4.63	6.16±0.55
Pre-term labour	15-22	10	20.0	11.83±1.44	76.23±6.42	9.01±0.47*
	23-28	20	57.1	10.43±0.70	88.83±1.35	8.09±0.73*
	29 and above	10	22.8	12.52±1.73	86.23±1.73	10.37±1.53

* Values are mean ± SE :

Table III

Blood magnesium, calcium and zinc concentration during pre-term labour cases in different parity groups

Subjects	Magnesium		Calcium		Zinc	
	Control	Subjects	Control	Subject	Control	Subject
Pre-term labour 20-28 weeks						
Prima Gravida	17.63±1.23	14.43±4.00	108.13±5.02	100.51±10.41	10.03±0.30	8.60±0.60*
2nd Gravida	18.43±0.60	14.23±2.03*	105.57±2.90	85.41±3.28+	9.70±0.50	9.07±0.60
3rd Gravida	9.03±1.03	13.23±2.64	110.43±9.19	80.72±7.05*	8.80±0.50	8.04±1.07
Pre-term labour 29-37 weeks						
Prima Gravida	17.63±0.86	11.03±1.03*	103.13±4.09	81.07±7.03*	14.80±1.70	8.56±1.2*
2nd Gravida	14.63±0.60	11.43±1.23*	99.12±5.09	102.45±8.05*	11.84±0.70	9.03±1.23
3rd Gravida	19.43±1.23	10.05±2.03*	102.47±8.08	76.08±8.36*	10.75±0.66	9.05±1.46

* Values are mean ± S.E., P< 0.05 compared to respective control.

Table IV

Blood magnesium, calcium and zinc concentration during pre-term labour cases in different socio-economic groups

Subjects	Magnesium		Calcium		Zinc	
	Control	Subjects	Control	Subject	Control	Subject
Pre-term labour 20-28 weeks						
High Income	14.43±1.23	12.83±1.26	120.03±6.03	78.03±9.03	9.03±0.9	9.6±1.1
Middle Income	12.63±1.03	9.63±1.03	82.03±4.03	64.03±5.03	9.4±0.4	9.2±1.0
Low Income	14.63±1.03	16.03±3.11	78.03±5.05	55.03±5.03	10.0±0.5	6.1±0.9
Pre-term labour 29-37 weeks						
High Income	18.13±2.06	9.63±1.63*	112.3±6.03	96.73±7.03	10.1±1.1	8.2±0.8
Middle Income	13.13±1.03	8.83±0.83*	104.3±6.11	88.03±4.11*	9.7±0.4	7.3±0.9
Low Income	12.83±1.23	6.23±1.08*	91.03±5.03	70.13±4.13*	9.3±2.0	7.5±0.6*

* Values are mean + S.E. * P< 0.55 compared to respective control

The levels of blood magnesium, zinc and calcium in case of pre-term labour (20-28 and 29-37 weeks) according to the parity are shown in Table 3. There was no statistical difference between the blood magnesium level of the subjects of different parity (Primi gravida, 2nd or 3rd gravida compared to respective control) except for a marginal decline in blood magnesium level in cases of preterm labour (20-28 weeks) 2nd gravida onwards. Blood calcium was significantly lowered in cases of pre-term labour of 2nd or 3rd gravida compared to primi gravida.

In the cases of preterm labour between 29-37 weeks, the levels of all the three essential metal was found to be significantly lowered in all the three parity groups when compared to the respective control. There was however, no significant influence on blood zinc level in both cases of pre-term labour (Table 3).

Blood magnesium, calcium and zinc levels according to socio-economic status are shown in table 4. There was generally a sharp decline in the concentration of three essential metals in subjects of preterm labour of low and middle income group. Interestingly, in the cases of preterm labour of 29-37 weeks there was no statistical difference in the level of these three essential metals, when compared according to their socio-economic status. All the three groups showed a general decline in the levels of blood zinc, magnesium and calcium level.

DISCUSSION

Prematurity and low birth weight are among leading causes of prenatal and infant mortality. There appears to be at least two mechanisms for development of such

abnormalities; i) overt maternal malnutrition and ii) deficient uteroplacental circulation leading to fetal malnutrition. The balance of nutrients in the internal system may be a regulating factor in the replication of growth and differentiation of rapidly forming and dividing cells such as the cells of fetus and placenta. Essential metals imbalance could be a leading cause of preterm labour and prenatal mortality and morbidity because of their role in various biochemical and physiological functions in human system. Calcium, magnesium and zinc are the major cations (elements), however, very few reports are available regarding their role in premature onset of labour. Serum magnesium level has been considered as parameters for the higher risk pregnancy involving pre-term births. Hypomagnesemia was also observed in cases of preterm labour cases of 29-37 weeks in our study are in agreement with findings of Deo et al (1990). Patients belonging to higher socio-economic class showed higher serum magnesium level (Deo et al 1990). Poor nutrition and improper hygiene leading to infection, malabsorption in cases belonging to lower socio-economic class may be responsible for low magnesium level.

Further in our study with increasing parity a fall in magnesium concentration was noticed. Few earlier reports indicate no significant influence of parity on blood magnesium level. This could be due to lesser number of subjects studied in these reports. However age and parity did not show any influence on magnesium level. Authors further recommend magnesium supplementation during pregnancy to avoid abortion and preterm labour. Like magnesium and calcium, zinc too had an importance in diet of pregnant women and which has been well established. Unlike magnesium serum, calcium homeostasis is under hormonal control. Pregnancy is a time of increased calcium demand. During pregnancy time there is an enhanced calcium absorption from the gut. A single model of calcium homeostasis demonstrates the increased need for calcium caused by the fetus from the maternal stand points. Low dietary calcium has also been related to increase in blood pressure (Villar et al 1985). These observations lead to the hypothesis that calcium supplementation favourably affects blood pressure in normotensive and hypertensive individuals both pregnant and nonpregnant (McCarron et al 1983). Zinc is an essential element for normal human reproduction. There are few reports of low plasma zinc in woman who developed hypertension in pregnancy (Metkoff et al 1981). Thus, low zinc level has been reported to be associated with abnormalities of labour, atonic bleeding, congenital malformation (Jameson 1976). Additionally, low levels of amniotic fluid zinc concentration has been associated with an increase risk of intra amniotic infection.

The results of present study thus indicate a definite role of zinc, calcium and magnesium in cases of pre-term labour.

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