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Original Research Article

STUDY OF SERUM IRON, SERUM ZINC AND SERUM ALKALINE PHOSPHATASE IN PREMATURE DELIVERY

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ABSTRACT

Background: Preterm labour can be multifactorial syndrome caused by multiple etiological mechanisms. It may present a short- circuiting of overwhelming of the normal parturition cascade whereby the feto-placental unit can trigger labor prematurity if intra-uterine environment becomes hostile and intimidate the wellbeing of the foetus. **Material & Methods:** The study will include 58 subjects who had preterm delivery taken as case.20 women taken as control and delivered at term (after 37 weeks).All subjects will be between 18 to 35 years of age. Serum alkaline phosphatase, Serum Zinc and Serum Iron was estimated. **R**esult: The maternal serum levels of alkaline phosphatase is greater while serum iron and serum zinc was lowered in preterm group as compared to the term. **Conclusion:** To conclude the present study gives us an idea that the studied biochemical parameters have some association with preterm delivery

Keywords: Premature delivery, Serum Zinc, Serum Iron, Serum Alkaline phosphatase

INTRODUCTION

The normal gestation period for human beings is said to be 40 weeks. The normal range varies from 37-42 weeks. Preterm labour is defined as birth before 37 weeks of gestation counting from first day of last menstrual cycle. **(1)** All over the world prematurity accounts for 10% of neonatal mortality i.e. around 500,000 deaths per year. In place of term preterm birth synonym premature birth is commonly used, refers to the birth of a baby before its organs mature enough to allow normal postnatal survival, and growth and development as a child. The risk of short and long term complications are associated with premature infants like growth retardation, mental development and disabilities. In the care of premature infants some significant progress has made but not in reducing the prevalence of preterm birth.

The present study has been undertaken to find out association of some biochemical parameter (serum alkaline phosphatase, serum iron, serum zinc) with pre-term labour and term labour, so that they might be used as marker for the prediction of pre-term labour, and preventing it by suitable interventions in early stages.

The volume of circulating blood is increased by 40% during normal pregnancy. About the 6th week of gestation the plasma volume begins to increase. During second trimester it increase rapidly and the last 3 months it increase slowly. The red cell mass is increased by 20-30 % and this increase continues throughout pregnancy. **(2)** Although a negative association between anemia and duration of gestation and low birth weight has been reported in the majority of studies, a causal link remains to be proven. The risk factors for the preterm delivery and intrauterine growth retardation and quiet similar ,although relatively little is understood about the influence of maternal nutritional status on risk of preterm delivery **(3)** explored potential biological mechanisms that might explain how anemia ,iron

deficiency or both could cause low birth weight and preterm delivery.

Abnormal fetal growth, both intrauterine growth retardation and malformation is reported to be associated with zinc deficiency in maternal serum **(4)**. Inadequate availability of maternal zinc to fetus is plausible etiological factor in fetal or placental growth failure because ,amongst it many important physiological roles ,zinc is necessary for DNA synthesis ,replication and transcription .It is therefore necessary for growth and development processed. Zinc is outstanding among trace elements for its multiple biological function **(5)** In human investigations, there is a higher incidence of congential abnormalities in infants delivered from mothers with low serum zinc concentrations**(6)**. Lowered zinc concentrations have also been reported in the leukocytes and uterine muscles of woman delivering small for gestation age versus normal infants **(7)** observed higher incidence of prematurity abnormal,inefficient and prolonged labour with atonic uterine bleeding and spontaneous abortion in women with low serum zinc levels in 14 weeks of pregnancy there is growing evidence that gestation zinc deficiency results immunodeficiency in the offspring.

Zinc requirement is increased in pregnancy which is to promote the growth of the fetus, placenta and maternal tissues **(8)** observed significantly low levels of zinc in pregnant women as compared to non-pregnant and explained it on the basis of uptake of zinc by the fetus and other products of conception, diminished quality of zinc binding proteins circulating blood or changed binding affinities of zinc and because of hormonal changes during pregnancy. **(9)**

MATERIAL AND METHODS

The present work was conducted in the department of Medical Biochemistry GMC, Bhopal in association with Department of Gynecology and Obstetrics GMC, Bhopal and Red Cross Hospital, Bhopal

Cases–Women with spontaneous preterm labor delivered before 37 weeks were taken as cases.

Controls: Women with spontaneous labor after 37 weeks were taken as control.

The study will include 58 subjects who had preterm delivery taken as case. 20 women taken as control and delivered at term (after 37 weeks).All subjects will be between 18 to 35 years of age.

Parameters Estimated- Serum alkaline phosphatase, Serum Zinc, Serum Iron

Exclusion criteria Women who had any medical, surgical or gynecological complications were excluded.

Collection of Sample-Maternal venous blood (5-10 ml) was collected in clean plain vials by venipunture. The blood was allowed to clot and the serum was collected in centrifuge tubes. Finally, supernatant collected was stored in 1.5 ml micro tubes in deep freezer till they were analyzed. Hemolyzed serum was discarded.

RESULT

As per the methodology and the tools described in the section material and methods. 58 were cases, who delivered before 37th week, 20 completed term and acted as control. The blood samples were taken at 28, 30, 32, 34 and 36 weeks during their visit to ante-natal clinic.

Table 1: Level of alkaline phosphatase at different gestational ages

Gestational age (weeks)	Cases (n=58) (M±SD)	Controls (n=20) (M±SD)	t	p
28	266.08 ± 34.59	154.2 ± 34.3	7.25	0.001
30	274.51 ± 21.45	178 ± 33.09	10.8	0.001
32	290.73 ± 47.02	191 ± 31.42	5.83	0.001
34	311.25 ± 75.92	201 ± 31.49	5.61	0.001
36	320.99 ± 100.77	217 ±39.01	1.49	0.001

The level of alkaline phosphatase increases in pregnancy because of increased synthesis by the placenta. So the level of alkaline phosphatase in the maternal serum might serve as an indicator of the placental condition. The maternal serum levels of alkaline phosphatase (IU/ L) measured by p-nitrophenyl phosphate (kinetic method) at different weeks of gestation. From the table it is clear that serum level of alkaline phosphatase is increasing with increase in gestation. But the serum level of alkaline phosphatase in cases is far higher than in

controls and the difference is found to be significant ($p< 0.001$) at 28, 30, 32, 34 weeks.

Table 2: Distribution of iron concentration in maternal serum at different gestational ages:

Gestational age (weeks)	Cases (n=58)	Controls (n=20)	t	p
28	64.42 ±13.14	70.8±11.16	0.6	>0.05
30	63.77±13.07	69 ±10.27	.06	>0.05
32	56.82± 11.9	66.2±9.41	1.23	>0.05
34	51.58±10.21	63.4±10.21	0.86	>0.05
36	53.84±7.37	59.4±10.11	1.24	>0.05

The distribution of the maternal serum iron (µg/dl) levels measured by dipyridyl method (colorimetry) at different gestational ages in the study group. It is clearly indicated in from the table there is decrease in the amount of iron in serum of pregnant ladies with increase in gestation .But not much difference is found in the levels of iron, though the cases have their values on the lower side of the controls and it is not statistically significant($p<0.001$). Not much is known about the role of nutritional in preterm delivery. Just to find out if there is any role of deficiency or overload of any essential nutrient required for the growth of the fetus leading to preterm delivery the serum level of iron and zinc has been taken up.

Table 3: Distribution of the maternal serum Zinc (µg/dl).

Gestational age (weeks)	**Cases (n=58)**	**Controls (n=20)**	**t**	**p**
28	58.66 ±16.71	69.2±10.08	0.91	>0.05
30	62.76±5.2	65.8±9.5	0.5	>0.05
32	61.8± 16.85	63.6±8.82	0.03	>0.05
34	47.54±25.86	61.2±8.22	1.23	>0.05
36	47.8±11.8	58.2±7.94	2.05	>0.05

The distribution of level of zinc in the maternal serum (µg/dl) measured by colorimetric method in the study group. The result shows that the concentration of zinc is lower in the case group as compared to the control though it is decreasing throughout with increase in gestational age .The difference is not found to be significant ($p<0.001$). Zinc is an essential element required for the growth, membrane integrity and immunity. It has been taken up in this study to correlate its functions with its serum levels in cases and controls and find out if there is any logical explanation for its association with preterm delivery

DISCUSSION

Alkaline phosphatase is an enzyme which is primarily synthesized by liver but other tissues like bone, placenta, kidney and intestine are also capable of synthesizing it. The level of alkaline phosphatase is more in pregnant ladies as compared to non-pregnant. According to the present study ,the level of alkaline phospahatase has been found to be higher in preterm group as compared to control group (deliveries occurring at term) as shown in Table 4 similar finding has been reported by Meyer et.all in other populations **(10,11,12)**

The increase in the level of alkaline phosphates in pregnancy is due to increase in number of cells synthesizing it. But it is increased even more in preterm delivery because of increased wear and tear of cells of placental. The finding of the present study indites the need for further investigation of the association between alkaline phosphatase and preterm birth. The requirement of iron increase tremendously during pregnancy iron is required for the increased synthesis of hemoglobin inside the body of pregnant lady. In the present study ,it has been found that though iron levels are low in preterm group as compared to term group though the difference is not significant (table 2) not much studies have been done on this topic .Rasmussen 2001 has summarized some biological mechanism that might lead to preterm delivery **(13)**

According to him,iron deficiency leads to hypoxia which causes increases in concentration of nor-epinephrine .This increase in nor-epinephrine level cause increase in the level of cortisol and corticotrophin releasing hormone .It is being thought that hypoxia due to decreased hemoglobin creates a state of stress in the pregnant lady which is death with by increased cortical and CRH.

Zinc is an essential micro mineral required for cell replication and normal growth, hence maintaining adequate zinc during pregnancy is important. Altered maternal zinc status has been linked with poor fetal growth(14)According to the present studies it has been observed the level of zinc is found to be lower in preterm in comparison to control group, though the difference is not significant statistically (table 3) similar findings have been reported by Bloxam et.al 1994 has reported that increased plasma zinc levels are associated with preterm delivery **(15)** Zinc is necessary for DNA synthesis, replication and transcription and it therefore necessary for growth and is needed for membrane function and integrity .It is therefore possible that disturbed maternal zinc metabolism may result in impairment of the placental feto maternal barrier .The lowering of zinc concentration may also be attribute to the stress conditions of the patient. Zinc deficiency is also related to lowering of immunity which might lead to infection and preterm delivery. Deficiency of zinc might also lead to decrease in the activity of antioxidant enzymes and cause free radical injury causing preterm labor.

SUMMARY AND CONCLUSION

From the results obtained from the study it is clear that –

- The maternal serum levels of alkaline phosphatase is greater in preterm group as compared to the term group which gives us the idea that there must have been some injury to the placenta due to hypoxia leading to infarction of the placenta and therefore increase in the level of alkaline phosphatase in the maternal serum.
- The serum level of iron is lower in preterm group. This low level of iron in the maternal serum might be responsible for the hypoxia that has created the stress condition in the fetus .This stressed condition might be the cause of the sequale stated above.
- Zinc is found to be lowered in maternal serum of preterm group as compared to the term group. The deficiency might be responsible for the loss of the membrane integrity of feto-placental unit. it might also lead to lowered immunity and increased tendency for the free radical injury.

To conclude the present study gives us an idea that the studied biochemical parameters have some association with preterm delivery. However since the size of the study group is very small, it needs to be studied further with bigger groups. They might also serve as predictors of the preterm if they are studied in maternal serum from early pregnancy at regular intervals and thus may help in prevention of maternal and fetal morbidity and mortality.

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