

ALKALINE PHOSPHATASE AND INORGANIC PHOSPHOROUS DURING PREGNANCY

by

P. V. PATEL,

A. V. POTNIS*

and

B. N. PURANDARE**

Introduction

Coryn in 1934, observed an elevation of alkaline phosphatase in late pregnancy. Cayla and Fabre (1935), Meranze *et al* (1937), Young *et al* (1946) have confirmed the elevation in alkaline phosphatase during pregnancy. Ramsay *et al* in 1938 referred the elevation to the osteoblastic activity in mother while Kerleau and Cayla (1939), Ebbs and Scott (1940) referred this as a passage of the fetal osteoblastic enzymes in the maternal circulation. However, Jung and Stark (1956), Klees and Frenzel (1960). Kubli (1961) have suggested that the increase may be due to the production of alkaline phosphatase by placenta.

Neale *et al* (1965) describe a simple method to discriminate alkaline phosphatase of placental and non-placental origin. The placental enzyme is unaffected by heating at 56°C for thirty minutes. Therefore, it is referred as the heat stable alkaline phosphatase. Since the heat stable alkaline phosphatase is of placental origin, the estimation of heat stable alkaline phosphatase can be taken as a fetoplacental test.

*Research Guide and Post-graduate Teacher, Seth G.S. Medical College, Parel, Bombay 400 012.

**Dean, Nowrosjee Wadia Maternity Hospital, Parel, Bombay 400 012.

Accepted for publication on 29-11-75.

It was decided to estimate inorganic phosphorus along with total alkaline phosphatase.

Material and Methods

The subjects for the said study have been selected from the Out Patient Department of Nowrosjee Wadia Maternity Hospital Bombay. Forty-three normal gravidas in first trimester, 34 normal gravidas in second trimester and 34 normal gravidas in third trimester have been studied. These subjects were examined by the resident medical officer on duty and were considered to be normal gravidas with no evident abnormalities. There was no evidence of hormonal deficiency in any of these patients. The age of these subjects varied from 18 to 40 years. In all cases studied, systolic pressure was less than 130 mm of Hg and diastolic pressure was less than 100 mm of Hg. The normal non-pregnant subjects were taken from the staff and students of K.E.M. Hospital and Seth G.S. Medical College, Bombay with same age group.

Amniotic fluid was collected from 18 patients in second trimester who were admitted to the hospital for the termination of pregnancy. These patients were absolutely normal but wanted to terminate pregnancy.

Alkaline phosphatase and inorganic

phosphorus were estimated by the method of King *et al* (1951).

Results

reaches to a mean value of 13.350 ± 4.471 K.A. units in second trimester. In the third trimester, it reaches to the peak value 18.730 ± 4.760 K.A. units.

TABLE I
Serum Total Alkaline Phosphatase

Group	Normal Non-pregnant	Trimester		
		1st	2nd	3rd
Number of cases	30	43	34	43
Serum total (K.A. units)	9.240	12.204	13.350	18.730
Standard deviation	± 2.080	± 5.096	± 4.471	± 4.760
Standard error	± 0.380	± 0.777	± 0.767	± 0.726
Coefficient of variation	22.511	41.750	33.490	25.410

TABLE II
Serum Inorganic Phosphorus

Group	Normal Non-pregnant	Trimester		
		1st	2nd	3rd
Number of cases	30	43	34	43
Serum inorganic phosphorus (mg.%)	3.330	3.346	2.738	2.499
Standard deviation	± 0.520	± 0.633	± 0.831	± 0.538
Standard error	± 0.095	± 0.097	± 0.143	± 0.082
Coefficient of variation	15.620	18.930	30.350	21.515

TABLE III
Alkaline Phosphatase and Inorganic Phosphorus in Maternal Serum and Amniotic Fluid

		Mean	Standard deviation	Standard error	Coefficient of variation
Alkaline phosphatase (K. A. units)	AF	9.196	± 7.063	± 1.665	76.805
	MS	14.390	± 5.419	± 1.277	37.620
Inorganic phosphorus (mg.%)	AF	1.954	± 0.774	± 0.182	39.611
	MS	2.472	± 0.691	± 0.163	27.970

Table I shows continuous increase in total alkaline phosphatase level as pregnancy advances. In normal non-pregnant group the mean serum total alkaline phosphatase is 9.240 ± 2.080 K.A. units. After conception the level increases to 12.204 ± 5.096 K.A. units. This level continues to rise as pregnancy advances and

Table II represents mean values of serum inorganic phosphorus in different groups. The value for normal non-pregnant group is 3.33 ± 0.520 mg. The value increases slightly in the first trimester reaching 3.346 ± 0.633 mg.%. Thereafter the level decreases. The mean value for second trimester is 2.738 ± 0.831 mg.%.

It decreases further in third trimester reaching the value of 2.499 ± 0.538 mg.%.

Table III represents levels of total alkaline phosphatase and inorganic phosphorus in amniotic fluid and maternal serum.

An elevation in serum alkaline phosphatase in the first trimester from normal non-pregnant group is significant ($P < 0.005$). Rest of all the elevations are significant to the extent of $p < 0.001$ except the elevation in second trimester from the first trimester which is not significant.

The depression in serum inorganic phosphorus level in second trimester from normal non-pregnant group and first trimester are significant ($P < 0.005$ and $p < 0.001$ respectively). Similarly, both the falls in third trimester from normal non-pregnant group and first trimester are significant to the extent of $p < 0.001$. The difference in levels of inorganic phosphorus in amniotic fluid and maternal serum is significant to the extent of $p < 0.005$.

Discussion

The results obtained in this study are in agreement with different workers in this field, Amritmahald and Banerjee (1950); McMaster *et al* (1964); Sadovsky and Zuckerman (1965); Kitchener *et al* (1965); Zuckerman *et al* (1965); Gupta *et al* (1969); Aleem (1972); Gupta *et al* (1973); Sunandabai *et al* (1974) who have noted a similar rise in serum total alkaline phosphatase as per the advancement of pregnancy. It is observed that the increase in serum total alkaline phosphatase level is because of the increase in heat stable enzyme of placental origin.

A fall in inorganic phosphorus may be attributed to an increased demand of phosphorus by fetus which must have

been transported through placental barrier.

Summary

1. Total alkaline phosphatase and inorganic phosphorus have been estimated in serum of pregnant women in different trimester and in amniotic fluid.

2. The increased levels of serum total alkaline phosphatase may be because of an increase in heat stable enzyme of placental origin.

3. The depressed levels of inorganic phosphorus may be because of the placental transport of this ion.

Acknowledgement

Authors thank Dr. C. K. Deshpande, Dean of K.E.M. Hospital and Seth G.S. Medical College for extending facilities and encouragement during this work.

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