

STUDIES ON ISO-ENZYMES OF SERUM AND PLACENTAL ALKALINE PHOSPHATASE IN INDIAN WOMEN

by

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The increase in maternal serum alkaline phosphatase is entirely due to heat stable iso-enzymes of alkaline phosphatase (Mc Master *et al* 1964; Peters and Parihar 1968). The heat stable fraction of alkaline phosphatase circulating in the sera of pregnant women has been shown to have placental origin (Mc Master *et al* 1964; Boyer 1961, 1963; Peters and Parihar 1969). Starch gel electrophoresis reveals many phosphatase components including a polymorphism in placentae of White and Negro women. A survey of literature reveals that similar studies have not been undertaken among Indian women.

In the present investigation, the heterogeneity of serum and placental alkaline phosphatase have been studied by starch gel electrophoresis during normal pregnancy and pre-eclampsia in order to explore the influence of gravity, sex of child and toxemia on the distribution of enzyme activity in different zones.

Method and Material

Sixty patients between the 36th and 43rd weeks of pregnancy were studied. Venous blood was collected and the separated serum was stored at 4°C for electrophoretic study.

500 mg. per cent aqueous homogenate of freeze dried placenta was prepared in all glass Potter-Elvehjem homogenizer. Vertical starch gel electrophoresis was performed with a discontinuous buffer

system (Poulik 1957) at 4°C. Zones of enzymes activity were developed directly on longitudinal gel slice by using a solution containing 0.05 per cent beta naphthyl sodium phosphate, 0.005 M magnesium sulphate, 0.05 per cent fast blue R R salt and 0.06 M sodium borate-boric acid buffer (Markert and Moller 1959).

The activity of alkaline phosphatase was estimated by the method of King and Armstrong (1934).

Results and Discussion

Boyer (1961) divided arbitrarily the non-specific alkaline phosphatase activity observed after electrophoresis, into A, B, C, D, E and F zones. According to him, the most rapidly migrating zone A, lies immediately cathodic to the transferrin C band while the D zone centers about the area of hepatoglobin 1-1 band. The results of present study show that the electrophoresis of sera of Indian women gives only A, B and F zones. D zone, which is limited to Negroes (Boyer 1961), was not observed in a single case.

Table I shows that the percentage of serum alkaline phosphatase activity increases in B zone in toxemia while that in F zone decreases. The activity of alkaline phosphatase in zone A is not significantly affected in toxemia. It is observed that the gravity of mother has no effect on the distribution of serum alkaline phosphatase activity in all the three zones A, B and F. (Table II).

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TABLE I
Showing the Values of Total Serum Alkaline Phosphatase and Enzyme Activity in Different Zones in Normal, Mild and Severe Toxaemic Pregnancy

	Total alkaline phosphatase activity in K.A. units.	Enzyme activity percentage in different zones.		
		A	B	F
Normal	12.18 ± 1.5	44.7 ± 4.9	43.77 ± 2.9	11.5 ± 1.5
Mild toxaemia	15.2 ± 1.4	44.3 ± 4.2	46.2 ± 3.1	9.5 ± .9
Severe toxaemia	16.8 ± 1.8	41.2 ± 2.9	48.3 ± 3.2	10.5 ± 1.0

TABLE II
Showing the Relation Between the Enzyme Activity in Different Zones and Gravidity of Mother

	Enzyme activity percentage in different zones.		
	A	B	F
Primigravida	44.8 ± 4.1	43.81 ± 3.9	11.8 ± 1.5
Multigravida	42.9 ± 3.5	42.9 ± 5.1	12.1 ± 1.6
Grand multigravida	46.1 ± 5.1	44.1 ± 3.9	10.9 ± 1.8

It is evident from Table III that in sera of mothers bearing a male child the activity of alkaline phosphatase is centered more in A zones as compared to that with female child. Similarly, the activity of enzyme is greater in B and F zones in sera of mothers bearing a female child as compared to the cases bearing a male child. These observations suggest that the predominance of A zone is indicative of a male child while zones B and F predominate when mother bears a female child (Table III).

The electrophoretic pattern of placental alkaline phosphatase showed only two prominent zones A and B. In cases of normal pregnancy the activity of alkaline phosphatase is greater in A zone as compared with that in B zone. (Table IV). Further it is evident from Table IV that in toxaemic cases, the activity of placental alkaline phosphatase is distributed more in B zone as compared to A zone.

Table V shows that the gravidity of mother has no significant effect on the distribution of placental alkaline phos-

TABLE III
Showing the Relation Between the Enzyme Activity in Different Zones and Sex of Child

Sex of child	Enzyme activity percentage in different zones.		
	A	B	C
Male	64.5 ± 5.2	30.3 ± 2.9	5.2 ± 1.1
Female	32.5 ± 2.9	55.7 ± 2.9	11.8 ± 1.2

TABLE IV

Showing the Values of Placental Alkaline Phosphatase and Enzyme Activity (percentage) in Different Zones in Normal Pregnancy and Mild and Severe Toxaemia

	Total placental alkaline phosphatase in K. A. units.	Enzyme activity percentage in different zones.	
		A	B
Normal	24.5 ± 2.9	59.8 ± 6.1	41.2 ± 5.2
Mild toxaemia	28.5 ± 2.5	45.5 ± 3.8	54.5 ± 4.2
Severe toxaemia	29.8 ± 1.8	38.8 ± 3.8	61.2 ± 5.8

phatase activity in A and B zone. It is observed that in the cases of a male child the activity of placental alkaline phosphatase is concentrated in A zone while in the cases of a female child the activity is concentrated in B zone. Further, greater distribution of enzyme activity in A zone both in sera and placenta suggest that A component is related to the development of male sex character. Similarly, B component seems to be related with the development of female characters. An extensive study is needed to test the utility of estimation of serum alkaline phosphatase activity in A and B zone in order to detect the sex of developing child before birth.

normal and toxaemic pregnancy. The distribution of enzyme activity in each zone was also studied.

(2) Sera show three zones after electrophoresis, while placentae show only two zones.

(3) Serum alkaline phosphatase activity is concentrated in A zones in normal pregnancy while in toxaemia, B component is richest in enzyme activity

(4) Gravidity of mother has nothing to do with the distribution of serum alkaline phosphatase activity in Zones A, B and F. Sera of mothers bearing a male child show maximum activity in A zone, while in cases of a female child Zone B is

TABLE V

Showing the Relation Between the Placental Enzyme Activity in Different Zones, Sex of Child and Gravidity of Mother

Enzyme activity in percentage.	Sex of child		Gravidity of mother		
	Male	Female	Primigravida.	Multigravida.	Grand multigravida.
A Zone	65.5 ± 5.2	41.5 ± 3.8	59.2 ± 5.8	58.9 ± 6.1	57.1 ± 5.2
B Zone	34.5 ± 3.1	59.5 ± 4.2	41.8 ± 4.5	42.5 ± 4.6	42.9 ± 4.2

Summary

(1) The heterogeneity of serum and placental alkaline phosphatase was studied by Starch gel electrophoresis in

richest in enzyme activity.

(5) Placental alkaline phosphatase shows only two zones, A and B, after starch gel electrophoresis. The activity

in A zone decreases in toxæmia while that in B zone increases.

(6) The distribution of placental alkaline phosphatase is not affected with change in gravidity of mother. Placentae with a male child show more enzyme activity in A zone as compared to those with female child.

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