

## STUDIES ON LEUCOCYTE ALKALINE PHOSPHATASE ACTIVITY IN NORMAL PREGNANCY AND LABOUR

by

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Placental dysfunction may be responsible for disturbances in foetal development and foetal loss. In order to reduce foetal loss, a simple and reliable placental function test would be useful. A method of approach to the problem is the determination of enzymes of placental origin or dependency. It was observed by Polishuk *et al* (1968), Sadovsky *et al* (1970), that leucocyte alkaline phosphatase activity (L.A.P.A.) in pregnancy is under the influence of placental hormones and thus reflects placental function.

### Material and Methods

The cases were selected from the Antenatal Clinics, Antenatal Ward and the Labour Room of the Irwin Hospital, New Delhi. There were 64 cases of normal pregnancy, consisting of 14 primigravidae and 50 multigravidae, and 12 cases in normal labour. The peripheral smears were collected during the first visit and at fortnightly intervals till labour. Two hundred and thirty such determinations were done. Of the patients who were in

labour, two blood smears were made at an interval of 2-6 hours and 24 hours.

The smears were air dried and fixed in cold acetone at 4°C for 3 hours and later in 95% ethyl alcohol for a few minutes and stained by the modified Gomori and Takamatsu (1939) method. Scoring was done by the method suggested by Kaplow (1955). Under oil immersion lens 100 consecutive polymorphs were examined. The phosphate granules stained from light brown to dark brown. Scoring was done as follows:

Score 0: Negative or colourless cytoplasm.

Score 1: Barely visible or diffuse staining of cytoplasm with occasional granules.

Score 2: Diffuse staining of cytoplasm with moderate granules.

Score 3: Strong positivity of cytoplasm with numerous granules.

Score 4: Very strong positivity with numerous granules.

The range of scores was 0-400. The control value for the present study was 15-118. The control values of 24 non-pregnant females in the age group of 18-35 years is shown in Table I. The mean control value was  $60.9 \pm 24.8$ .

Table II shows the results of 230 determinations of L.A.P.A. in 64 normal pregnant women. It shows a rapid rise of L.A.P.A. scores during the first and

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TABLE I  
Control Value of L.A.P.A. of 20  
Non-pregnant women

No. of determinations	Range of scores	Mean score	S.D.
20	15-118	60.9	24.8

The mean control value was  $60.0 \pm 24.8$ .

second trimesters of pregnancy and a gradual rise thereafter from the 28th week

38-40 weeks of gestation. Scores which ranged between 140-170 were taken as normal. Scores below 140 but above 120 were taken as scores on the lower side and scores below 120 were definitely considered as lower. Scores above 170 were considered to be higher. Any score on the higher or lower side of the normal value was considered as abnormal.

Table III shows the values of L.A.P.A.

TABLE II  
Results of L.A.P.A. Determinations in 64 Normal Pregnant Women

Gestation in weeks	No. of determinations	Leucocyte Alkaline phosphatase scoring		S.D.
		Range of scores	Mean	
6-10	6	62-85	75.3	7.96
10-14	6	78-113	95.3	11.14
14-18	12	73-138	106.2	16.5
18-22	20	105-160	127.8	17.3
22-24	6	125-150	139.7	10.2
24-26	10	120-176	147.4	20.1
26-28	12	126-170	148.7	14.4
28-30	16	128-188	145.7	16.9
30-32	14	114-175	149.5	17.7
32-34	28	123-184	154.9	17.5
34-36	32	130-179	154.7	13.9
36-38	28	132-185	156.6	17.8
38-40	24	122-176	152.9	15.06
40	16	120-177	140.1	16.36

till the 39th week of gestation. At 40 weeks of gestation there was a slight fall in the values preceding the onset of labour, by 3-4 days, which was noted in 14 cases. We also tried to find out if there was any relationship between L.A.P.A. and parity, but could not find any such relationship.

During the first and second trimesters a rapid rise is followed by a gradual rise up to the 39th week of gestation. The control values of L.A.P.A. in our series of normal pregnancy was 148.7 at 26-28 weeks, 145.7 at 28-30 weeks, 149.5 at 30-32 weeks, 154.9 at 32-34 weeks, 154.7 at 34-36 weeks, 156.6 at 36-38 weeks and 152.9 at

of 24 determinations in 12 women in normal labour, during the first, second and third stages of labour. The range of scores was 180-306 with a mean of 235.2. There was a significant rise in L.A.P.A. during labour rising from a mean score of above 140.1 at 40 weeks to a mean of 235.2. There was no difference in the L.A.P.A. during the three stages of labour.

Table IV shows the L.A.P.A. and birth weights in 22 normal pregnant women at 39 weeks of gestation, because the scores fell a little at 40 weeks. The mean birth weight was 2986.2 gms. and the range was 2400-3830 gms. No definite correlation was

TABLE III  
Values of L.A.P.A. Determinations in 12  
Women in Normal Labour

First stage	Second stage	Third stage
204	218	214
190	187	180
245	252	240
287	304	306
247	237	256
194	200	188
260	276	244
238		
237		
240		
Mean Score	Mean score	Mean score
234.2	239.1	232.6

TABLE IV  
Leucocyte Alkaline Phosphatase Activity Scores  
at 39 Weeks of Gestation in 22 Normal Pregnant  
Women and Birth Weights of Their Infants

Birth weights in gms.	2400-2900	2901-3400	3400
Leucocyte	172	144	171
Alkaline	171	155	152
Phosphatase	130	171	
Activity	148	152	
Scores	153	163	
	140	166	
	169	136	
	135	174	
	161		
	149		
	152		
	127		
	Mean score	Mean score	Mean score
	150.6	157.6	161.5

observed between birth weights and L.A.P.A. scores.

#### Discussion

The results of the present series of L.A.P.A. scores in the normal pregnant women during the three trimesters of pregnancy and in the different weeks of

gestation, showed that there is a wide scatter of the L.A.P.A. For the purpose of evaluation of the scores of L.A.P.A. from the 28th week of gestation onwards were taken into consideration. The mean scores were  $145.7 \pm 16.9$  at 28-30 weeks,  $149.5 \pm 17.7$  at 30-32 weeks,  $154.9 \pm 17.5$  at 32-34 weeks,  $154.7 \pm 13.9$  at 34-36 weeks,  $156.6 \pm 17.8$  at 36-38 weeks,  $152.9 \pm 15.06$  at 38-40 weeks and  $140.1 \pm 16.36$  at 40 weeks. It was seen that the L.A.P.A. scores at 40 weeks of gestation was significant only in a few cases and all of them went into spontaneous labour within 3-4 days, of the estimation.

Increase in L.A.P.A. in pregnancy was demonstrated by Valentine *et al* (1952) and Valentine and Beck (1957). Pritchard (1957) in his study found rising levels of L.A.P.A. in the first trimester reaching a maximum during labour and early puerperium. In 1960, Quigley *et al*, found a constant elevation of an enzyme activity in leucocytes during pregnancy, maximum being at labour and puerperium.

Polishuk *et al* in 1970 determined L.A.P.A. in 222 pregnant women during normal pregnancy and labour. They observed that the L.A.P.A. scores increased with the progress of pregnancy and produced a characteristic curve. The enzyme activity rose steeply in the first trimester of pregnancy, reaching a peak in the 24th to 26th weeks. Afterwards the curve remained flat and dropped sharply a few days prior to delivery. Elder *et al* in 1971 in their studies also found a similar distribution pattern of scores in normal pregnancy. Table V compares the results of previous workers with our series of L.A.P.A. scoring in normal pregnancy. The scores of L.A.P.A. were similar in distribution to the above others but the average scores were slightly higher than

TABLE VI

Results of Mean Leucocyte Alkaline Phosphatase Activity Scores of Various Authors in Comparison to the Present Series in Normal Pregnancy

Foetal maturity in weeks	Quigley <i>et al</i> (1960)	Polishuk <i>et al</i> (1970)	Elder <i>et al</i> (1971)	Present Series (1975)
28-30		144.5	124.1	145.7
30-32	158	147	127.4	149.5
32-34	in	150	127.9	154.9
34-36	third	150	123.3	154.7
36-38	trimester	145	124.6	156.6
38-40		141	125.6	152.9
40		105	118.4	140.1

the values mentioned by Polishuk *et al* and Elder *et al* in their series.

The great variation in the enzyme activity scores noted by various authors is due to the difference in the technique and the different substrates used. This could also account for the variation of scores in our series. It is to be emphasised that non-pregnant control scores for the technique to be employed should be established before determining the scores in pregnancy. The present study substantiated the observations of previous workers that there is a rise in the L.A.P.A. during pregnancy beginning from early pregnancy and continuing till term, the rise being rapid during the first and second trimester and gradual during the third trimester, with a drop in scores at 40 weeks which precedes the onset of labour.

There was a wide range of normal scores in our series, the range being 140-170 scores below 140 were considered abnormal on the lower side of normal and scores below 120 were abnormal. serial estimations should be carried out to determine the normal functioning of the placenta. Also two or three serial estimations give better results so that the errors occurring due to the staining are minimised.

During labour in our studies, a signi-

ficant rise in L.A.P.A. scores were observed rising from a mean of 140.1 at 40 weeks to a mean of 235.2. There was no difference in the scores during the three stages of labour. The above findings correlate well with those of Quigley *et al* (1960), Goldstein (1965), Polishuk *et al* (1970) and Elder *et al* (1971). They also observed a significant rise in L.A.P.A. scores during labour.

The birth weights of infants delivered by 22 women and their relationship to the L.A.P.A. are shown in Table V the mean enzyme activity scores were 150.6 with infants weighing between 2400-2900 gms, 157.6 with 2901-3400 gms and 161.5 with infants more than 3400 gms. There is no significant differences between the scores. We did not find any correlation between birth weights and L.A.P.A. scores. These findings correlate well with the studies of Elder and Bonnello (1971) who found no such relation in 76 cases studied by them.

#### Summary and Conclusions

1. The L.A.P.A. score in 20 non-pregnant women in the reproductive age group was 60.9.

2. The mean L.A.P.A. scores in normal pregnant women was 140-170, 120-140

were considered to be on the lower side and below 120 were abnormal.

3. There is a tendency to rise in scores during the first and second trimesters, as a sharp rise, followed by a more gradual rise in the third trimester. The values dropped at 40 weeks, in 75% of the cases and this preceded the onset of labour by 3-4 days.

4. The scores rose significantly from a mean of 140.1 to a mean of 235.2 during labour, with no significant difference in the scores during the three stages of labour.

5. No correlation was observed between foetal birth weight and L.A.P.A. scores in normal pregnancy.

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