

AN ELECTROPHORETIC STUDY OF SERUM PROTEINS IN ANAEMIA WITH PREGNANCY

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Introduction

Of the various health hazards facing the malnourished Indian women anaemia is of prime importance. The problem of anaemia, being the most important cause of maternal mortality has evinced especial interest as social Obstetrics has assumed greater dimensions (Upadhyay 1944). In pregnancy plasma volume increases causing fall in the level of serum proteins (Kishore *et al*, 1963; Krishna Menon 1965), which is further aggravated by substandard nutrition in our country (Upadhyay 1971). As dietary proteins have a role to play in erythropoiesis early diagnosis and rectification of hypoproteinaemia is essential to deal with this problem.

Material and Methods

In the present study 50 normal non-pregnant women including medical students, nurses and attendants of the patients were studied as control cases. Fifty pregnant women with normal haemoglobin were also studied as control cases.

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Study group consisted of 100 pregnant women with varying degree of anaemia. A complete haemogram along with stool examination for ova and cyst was done in each case of study group. Serum of each case was subjected for horizontal paper strip electrophoresis (Franklin and Martin, 1960). Electrophoretograms were studied with the help of densitometer.

Observations

The cases studied were divided in the following groups—

Group I: This consisted of 50 normal non-pregnant women with haemoglobin above 12.0 gm. per cent. Table I shows the serum protein pattern in this group.

Group II: consisted of 50 pregnant non-anaemic women having average haemoglobin above 12.0 gm. per cent. Table II shows details of protein patterns in pregnant cases. Fig. I shows electrophoretogram of such a case.

Group III: consisted of 100 pregnant women having haemoglobin 9.0 gm. per cent or below. Depending upon the severity of anaemia, the cases of this group were sub-divided in the following two groups—

III A—included 42 cases having haemoglobin between 6.0 to 9.0 gm. per cent.

III B—included 58 cases having haemoglobin below 6.0 per cent.

TABLE I
Serum Protein Patterns in Non-pregnant Women

Values	Hb. in gm. %	Total serum proteins in gm. %	Albumin in %	Globulins			
				Alpha ₁	Alpha ₂	Beta	Gamma
Average	12.5	6.77	57.6	4.18	8.3	9.4	19.9
Maximum	13.5	7.64	61.8	5.3	9.6	11.2	21.4
Minimum	12.0	6.31	54.3	4.4	7.6	8.4	16.5

TABLE II
Serum Protein Pattern in Pregnant Women

Values	Hb. in gm. %	Total serum proteins in gm. %	Albumin in %	Globulins			
				Alpha ₁	Alpha ₂	Beta	Gamma
Average	12.5	6.18	46.8	7.5	10.3	14.8	20.6
Maximum	13.0	6.7	46.2	9.9	13.2	19.6	29.8
Minimum	12.0	5.9	38.1	5.1	9.4	16.9	25.4

Serum proteins patterns in the two sub-groups are depicted in Table III. Fig. II shows the electrophoretogram of a case from group III A and Fig. III shows electrophoretogram of a case from group III B.

superimposition of anaemia, total serum proteins were reduced by 1.38 gm. per cent in group III A and by 2.08 gm. per cent in group III B. Minimum serum proteins were found to be 3.4 gm. per cent in the study group.

TABLE III
Serum Protein Patterns in Anaemic Cases

Values	Hb. in gm. %	Total serum proteins in gm. %	Albumin in %	Globulins			
				Alpha ₁	Alpha ₂	Beta	Gamma
Group IIIA							
Average	7.0	4.8	39.6	7.6	9.8	16.8	28.9
Maximum	9.0	5.1	43.5	9.8	14.6	20.2	31.7
Minimum	6.0	4.0	36.8	7.1	8.6	14.6	24.3
Group IIIB							
Average	3.0	4.1	29.4	8.6	11.6	18.5	37.8
Maximum	5.5	4.4	37.0	11.4	14.8	20.9	39.8
Minimum	2.0	3.4	27.6	7.6	10.2	16.4	30.6

From the above Tables it is evident that there was fall in total serum proteins by 0.5 gm. per cent in normal pregnant women as compared to the normal non-pregnant group. However, with

Albumin fraction was found to be reduced by 10.8 per cent in group II as compared to group I. Further significant reduction by 18.0 per cent was observed in group III A and by 17.4 per cent in

group III B. It seems that with increase in the degree of anaemia there is fall in albumin fraction.

Among the globulin fractions α_1 did not reveal any significant change in any of the groups in the present study. α_2 globulin was 8.3 per cent in control group of non-pregnant women, while it was 10.3 per cent among the normal pregnant women. Maximum value of 14.8 per cent was observed in group III B. This shows that α_2 fraction is higher in anaemia as well as in normal pregnancy.

Beta globulin was observed to be raised in normal pregnancy as well as in cases of anaemia with pregnancy. Rise was by 5.4 per cent in group II, by 7.4 per cent in group III A and by 9.1 per cent in group III B. Overall rise in Beta globulin was directly related to the reduction in haemoglobin and total serum protein.

Gamma globulin was definitely higher in cases of anaemia complicating pregnancy, while it was within the normal range in normal pregnant cases. The rise was maximum (39.8 per cent) in group III B where the serum albumin was minimum i.e. 27.6 per cent. In 9 out of 58 severely anaemic cases bands of Beta and Gamma globulin were slightly fused. Such a fusion was also observed in 4 out of 42 moderately anaemic cases, while no such finding was observed in non-anaemic group.

Discussion

Normal serum proteins vary widely from country to country and even in the different parts of the same country (Mack *et al.*, 1951; Purandare *et al.*, 1954; Brown 1956; Kishore 1965). Comparatively low average serum proteins in Indians have been attributed to the die-

tary habits and malnutrition along with other allied factors.

In normal women mean serum proteins were 6.7 gm. per cent while in normal pregnant women they were 6.1 gm. per cent i.e. nearly reduced by 0.6 gm. per cent. This fall has been also observed by (Agarwal 1965; Menon 1965; Upadhyay 1971; and Rao 1972). This reduction in serum proteins was also associated with decrease in albumin and increase in globulin fractions. Both, reduction in serum proteins and its albumin fraction lead to decrease in erythropoiesis and thus aggravates anaemia (Menon 1965; Subramanyam 1970).

On the other hand, in groups III A and III B total serum protein were reduced by 1.38 gm. per cent and 2.18 gm per cent respectively as to group II. These findings are consistent with those of Upadhyay 1971 and Rao 1972. The fall in the serum proteins aggravates anaemia leading to increased maternal mortality from 20 to 40 per cent (Menon 1965; Lahiri 1970).

While considering the different fractions in groups II and III albumin was reduced by 7.2 and 17.4 per cent respectively. Reduction in albumin leads to derangement of vital functions such as metabolism, cell growth and haematopoeisis (Upadhyay 1969 and 1971). α_1 globulin remained practically unaltered (Devi 1964; Subramanyam 1970). α_2 was reduced in group III A but increased in group III B.

Beta globulin was higher in group II as compared to group I but it was further increased by 8.3 per cent and 17.2 per cent in groups III A and III B respectively as compared to group II. Gamma globulin was markedly raised in severely anaemic patients 17.2 per cent while the rise was moderate in mildly anaemic pa-

tients 8.3 per cent. The rise in gamma globulin is attributed to increase in immunoglobulin specially immunoglobulin 'G' component which supplies antibodies to the foetus (Upadhyay 1971) and also to counterbalance the total serum protein level which ultimately does not prove truthful as vital functions are mainly played by serum albumin. It has also been suggested that in cases of severe anaemia immunoglobulin 'G' may not pass from the placenta to the foetus and hence latter is exposed to greater risks.

Thus, in electrophoretogram with marked increase in Beta and Gamma bands reflects the seriousness of the problem and warns for urgent management of the case.

Summary

1. Total serum proteins and its various fractions were studied in 50 normal non-pregnant women, 50 normal healthy pregnant women and in 100 pregnant women having varying degree of anaemia.

2. Total serum proteins were found to be reduced by .5 gm. per cent during normal pregnancy as compared to non-pregnant women. With superimposition of anaemia total serum proteins were further found to be reduced. This fall was parallel to the degree of anaemia.

3. Albumin was found to be reduced by 10.8 per cent during normal pregnancy as compared to non-pregnant controls. There was a further fall by 17.42-18.0 per cent in anaemic patients.

4. Alpha₁ globulin did not reveal any significant change during pregnancy or anaemia with pregnancy. Alpha₂ globulin was found to be raised in normal pregnancy and in cases of superimposed anaemia. Beta globulin also revealed a

higher value in normal pregnant mothers and was further raised in anaemic pregnant. This rise was directly related with degree of anaemia.

5. Gamma globulin was definitely higher in anaemia complicating pregnancy, while it was within normal range in normal pregnant subjects. This rise has been attributed to increase in immunoglobulin.

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See Figs. on Art Paper I-II