

SERUM PROTEINS IN PREGNANCY WITH TOXAEMIA

by

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It has been observed by many workers (Kulkarni, 1960; Kishore and Gupta, 1963, Basu and Arulanthan 1973) including the authors in an earlier study that there are marked changes in the serum protein level of women during normal pregnancy. These workers have all found a general decline in the total serum protein level during pregnancy. The interesting fact observed in this regard is that this fall is solely accounted for by the decrease in the serum albumin. The globulins, on the other hand, showed a significant rise. Sometimes, pregnancy is accompanied by toxæmia which gives rise to many complications. It also adds a pathological stress to the mother in addition to the already existing physiological stress i.e. pregnancy. It is well known that there is a continued proteinuria during toxæmia. The precise cause of pre-eclamptic toxæmia is still not clear and therefore this work was undertaken to study if any changes occurred during toxæmia of pregnancy in the mother's

serum protein, pattern in relation to normal pregnancy.

Material and Methods

The clinical material was taken from among the patients admitted into the obstetric ward and those attending antenatal clinic of the Darbhanga Medical College Hospital and their female attendants of child bearing age.

The cases were divided into the following 3 groups:

Group I—Control: This group consisted of 25 normal non-pregnant females.

Group II—Normal pregnancy: This group consisted of 50 healthy pregnant females without any complication.

Group III—Pregnancy with toxæmia: There were 25 pregnant females in this group who presented with pre-eclampsia i.e. hypertension, oedema and albuminuria.

MicroKjeldahl method was adopted for total protein estimation which was done on the day of selection in the control group and during the second stage of labour in the two test groups. Fractionation was done alongside by horizontal paper electrophoresis on Whatman No. 1 Filter paper. Strips using barbiturate buffer ($M = 0.05$) at pH 8.6. The strips were dried, stained and scanned in a densitometer to assess the different protein fractions.

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Observations

TABLE I
Total and Differential Protein Levels in Control Group

Sl. No.	Category	Normal Non-pregnant Cases (Control) 25 cases			
		Range	Mean	S.D.	S.E.M.
1.	Total protein in gm. %	6.20-7.94	7.23	0.44	0.09
2.	Albumin in gm. %	3.30-4.68	4.11	0.32	0.065
3.	Globulin in gm. %	2.62-3.37	3.06	0.19	0.04
4.	Differential globulin in gm. %				
	(a) Alpha ₁	0.20-0.30	0.24	0.033	0.0068
	(b) Alpha ₂	0.41-0.72	0.58	0.088	0.018
	(c) Beta	0.73-0.93	0.83	0.052	0.010
	(d) Gamma	1.24-1.58	1.41	0.106	0.021
5.	A.G. Ratio	1.13-1.47	1.33	0.088	0.018

TABLE II
Levels of Total and Differential Proteins in Normal Pregnancy

Sl. No.	Category	Normal Mothers at Delivery (50 subjects)			
		Range	Mean	S.D.	S.E.M.
1.	Total protein in gm. %	5.20-6.78	6.036	0.36	0.041
2.	Albumin in Gm. %	2.15-3.23	2.65	0.27	0.032
3.	Globulin in gm. %	2.76-4.12	3.39	0.29	0.034
4.	Differential globulin in gm. %				
	(a) Alpha ₁	0.27-0.75	0.48	0.13	0.015
	(b) Alpha ₂	0.28-0.78	0.49	0.13	0.015
	(c) Beta	0.79-1.17	1.00	0.10	0.011
	(d) Gamma	1.14-1.68	1.42	1.14	0.016
5.	A.G. Ratio	0.54-1.006	0.78	0.11	0.013

Mean = Statistical Mean.

S.D. = Standard Deviation

S.E.M. = Standard error of mean

TABLE III
Levels of Total and Differential Proteins in the Pre-eclampsia Group

Sl. No.	Category	Mothers with Pre-eclampsia (25 cases)			
		Range	Mean	S.D.	S.E.M.
1.	Total protein in gm. %	4.88-5.72	5.737	0.22	0.050
2.	Albumin in gm. %	2.02-2.84	2.42	0.26	0.053
3.	Globulin in gm. %	2.53-3.25	2.93	0.054	0.012
4.	Differential globulin in gm. %				
	(a) Alpha ₁	0.24-0.52	0.37	0.06	0.013
	(b) Alpha ₂	0.23-0.66	0.45	0.06	0.013
	(c) Beta	0.52-0.86	0.70	0.066	0.014
	(d) Gamma	1.08-1.62	1.40	0.16	0.036
5.	A.G. Ratio	0.66-0.93	0.83	0.098	0.021

Mean = Statistical Mean

S.E.M. = Standard error of mean.

S.D. = Standard Deviation

TABLE IV
Statistical Comparison of Mean Serum Protein Levels in Different Groups

Group	No.	Mean total serum protein in gm%	Mean albumin	GLOBULINS					A.G. ratio
				Total	Alpha ₁	Alpha ₂	Beta	Gamma	
1. Control	25	7.23	4.11	3.06	0.24	0.58	0.83	1.41	1.33
2. Normal-Pregnancy	50	6.04	2.65	3.39	0.48	0.49	1.00	1.42	0.73
3. Pregnancy with pre-eclampsia	25	5.37	2.42	3.93	0.37	0.45	0.70	1.40	0.83 ^{**}
4. Group 1 Vs 2	t	12.24	18.80	6.70	14.20	3.71	11.40	0.26	21.70
	p	<.001	<.001	<.001	<.001	<.001	<.001	**	<.001
		(-)	(-)	(+)	(-)	(-)	(+)		(-)
5. Group 2 Vs 3	t	10.00	3.30	12.70	5.17	1.84	15.7	1.52	1.88
	p	<.001	<.001	<.001	<.001	**	<.001	**	**

<.001 = Highly significant

** = Insignificant.

Discussion

In the present study, the mean total serum protein level in the control group was 7.23 ± 0.44 gm.% which fell to 6.04 ± 0.36 gm.% in the normal pregnancy group and further to 5.37 ± 0.22 in the preeclampsia group. The mean albumin level also showed a similar trend, coming down from the control level of 4.11 ± 0.32 gm.% to 2.65 ± 0.27 gm.% in normal pregnancy and to 2.54 ± 0.26 gm.% in pregnancy with pre-eclampsia. The mean total globulin level has, however, shown a different response to pregnancy and toxæmia. While in normal pregnancy it showed a rise to 3.39 ± 0.29 gm.% from a control level of 3.06 ± 0.19 gm.% in pregnancy with pre-eclampsia it actually fell to 2.93 ± 0.05 gm%. All these observed changes are statistically significant at the .001 level (Table IV).

Of the different fractions of the globulins the alpha₁ fraction showed a significantly less marked rise over control in

pregnancy with pre-eclampsia than in normal pregnancy. It will be evident from the Tables that while in normal pregnancy it has risen to 0.48 ± 0.13 gm.% from the control level of 0.24 ± 0.03 gm.%, in the pre-eclampsia group it has risen only to 0.37 ± 0.06 gm.%. The difference in the rise in the normal pregnancy group and the pre-eclampsia group is also statistically significant.

The beta globulins also showed a reversed response in the pre-eclampsia group in relation to the normal pregnancy group. Thus while in the normal pregnancy group it rose to 1 ± 0.1 gm.%, in the pre-eclampsia group it showed a decline to 0.70 ± 0.07 gm.%. This fall is also statistically significant ($P = < .001$). The gamma globulins did not show any significant change in any of the two test groups as compared to the control.

Many workers, notably Harold *et al* (1951); Khanijo and Jungalwalla (1963) and Basu *et al* (1973) have also observed a similar fall in the total protein and albu-

min levels in the sera of pregnant women presenting with pre-eclampsia in relation to normal pregnancy. Mach *et al* (1951) have observed a fall in the beta globulins in their study also. While the significantly lower values for total proteins and albumin in normal pregnancy have been attributed to the accompanying haemodilution and increased ACTH production due to pregnancy stress as well as the increased fetal nitrogen demand on the maternal system, the exact mechanism of the exaggerated decrease during toxemia has not been elucidated. It has been suggested by Kulkarni *et al* (1960) and Basu *et al* (1973) that it may probably be due to diminished liver function in toxemia. The concurrent albuminuria may also be a very important contributory factor in the causation of the hypoproteinaemia and hypoalbuminaemia as considerable amount of protein, predominantly albumin, is lost in urine. The lower level of alpha globulin in toxemia as compared to normal pregnancy may also be caused by the impairment of liver function in these patients.

The fall in the level of beta globulins in the toxemia group agrees with the findings of Kishore and Gupta (1963) and Sita Devi (1969). Mach *et al* (1951) suggested that this was in some way related to the premature fall of the serum oestrogen level in the pre-eclampsia cases.

The gamma globulin level does not show any significant change in any group. It has been suggested that the foetus draws its total gamma globulin requirement from the mother. In normal pregnancy possibly the placental transfer approximately equals the increased production by liver keeping the gamma globulin level fairly constant. But toxemia results in impaired placental function thereby

decreasing the placental transfer of the gamma globulin from the mother to the fetus. It is possible that by some mechanism the production of the gamma globulin in the toxemic patients is depressed so that there is no significant change in its level in toxemia also.

Summary

Serum protein in 25 normal non-pregnant, 50 normal pregnant and 25 women with pre-eclampsia has been studied. A fall in total protein and albumin has been observed in normal pregnancy which is more exaggerated in toxemia. The total globulins showed a rise in normal pregnancy but a significant fall in toxemia. The alpha globulin level rose in both the groups but rise in toxemia was less than the rise in normal pregnancy. The beta globulins showed a significant fall in toxemia as opposed to a significant rise in normal pregnancy. Their causes have been discussed.

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