A COMPARATIVE STUDY OF SERUM PROTEINS OF MOTHER DURING PREGNANCY, AT DELIVERY AND OF CORD BLOOD

by

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Proteins, the complex nitrogenous substances, built up from amino-acids, are present in the body in various forms and have multifarous functions. Their role in metabolism is well known.

Diminished total serum proteins and albumin were observed in pregnancy by Kulkarni *et al* (1960) and Kishore and Gupta (1963). Eastman (1930) observed, in his cases of pre-eclampsia, diminished total proteins and marked an absolute increase in globulin. He attributed these changes to be responsible for eclampsia.

Material and Methods

The present study was carried out on 320 patients (including new born babies) attending the U.I.S.E. Maternity Hospital, Kanpur. Cases selected included 30 non-pregnant females (as control), 110 females in different trimesters of normal pregnancy, 30 cases each, in third trimesters of pregnancy associated with anemia and toxaemia, 50 delivered patients (within an hour of delivery) and 70 babies born to these patients.

Total serum proteins were estimated by Nesslerization method (King, 1951) and different protein fractions by the electrophoretic method (Beckman Technical Bulletin, 1965).

Observations and discussion

Table 1 shows the values of serum proteins in 30 non-pregnant females (control) as compared to values reported by various authors.

In the first trimester of pregnancy, (30 cases) no change in the value of total serum proteins was observed, mean value being 6.79 gm.%. The mean value of serum albumin, however, decreased to 4.19 gm.% while globulin value increased to 2.59 gm.% alpha 1, alpha 2 and beta globulins were significantly raised, values being 0.29 gm.%, 0.53 gm.% and 0.77 gm.% respestively. Mean values of gamma globulins remained unaltered.

Table II shows mean values of serum proteins in 3rd trimester of normal pregnancy (50 cases) as compared to figures reported by various authors.

The mean value of total serum proteins decreased from 6.79 gm.% in 1st trimester of pregnancy to 6.58 gm.% and 6.18 gm.%

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TABLE I

Serum Protein Values Reported by Various Authors

Name of Author	Total Serum Protein gm.%	Serum Albumin gm.%	Serum Globulin gm.%	Alpha 1 gm.%	Alpha 2 gm.%	Beta gm.%	Gamma gm.%
Brown (1954)	7.10	4.19	2.89	0.36	0.69	0.99	0.85
Menon et al (1956)	7.41	4.04	3.36	0.34	0.69	0.91	1.39
Purandare & Agashe (1959)	7.15	4.18	3.00	0.19	0.34	0.82	1.65
Kulkarni (1960)	6.76	4.32	2.44	0.15	0.47	0.67	1.15
Kishore & Gupta (1963)	7.29	4.29	3.06	0.32	0.65	0.85	1.24
Present Series	6.78	4.52	2.29	0.22	0.39	0.68	1.00

TABLE II

Value of Serum Proteins Reported by Various Authors in Third Trimester of Pregnancy

Name of Author	Total Serum Protein gm.%	Serum Albumin gm.%	Serum Globulin gm.%	Alpha 1 gm.%	Alpha 2 gm.%	Beta gm.%	Gamma gm.%
Brown (1954)	6.48	2.88	3.56	0.59	1.03	1.31	0.65
Menon et al (1956)	6.46	2.37	4.04	0.60	0.92	1.14	1.40
Purandare & Agashe (1959)	6.37	2.94	3.43	0.34	0.56	0.97	1.79
Kulkarni et al (1960)	5.56	2.69	2.87	0.26	0.59	0.82	1.20
Kishore & Gupta (1963)	6.18	2.47	3.52	0.62	0.82	1.02	1.16
Present series	6.18	2.69	3.48	0.69	0.80	0.95	1.01

in 2nd and 3rd trimesters of pregnancy respectively. The mean values of serum albumin decreased to 3.43 gm.% in 2nd trimester of pregnancy and 2.69 gm.% in 3rd trimester of pregnancy. In the 2nd trimester of pregnancy mean value of serum globulin rose to 3.14 gm.% and to 3.48 gm.% in 3rd trimester of pregnancy. The average values of alpha 1, alpha 2 and beta globulins in 2nd trimester of pregnancy were 0.51 gm.%, 0.70 gm.% and 0.89 gm.% respectively, whereas in the third trimester of pregnancy the values were 0.69 gm.%, 0.80 gm.% and

0.95 gm.% respectively. Gamma globulin values remained fairly constant throughout pregnancy, values being 1.00 gm.%, 1.03 gm.%, 1.01 gm.% in the 1st, 2nd and 3rd trimesters respectively.

Table III shows comparative values of serum proteins in delivered cases as reported by various authors. In the present series 50 cases of normal delivery were studied.

In the present series 30 cases (9.4%) were that of toxaemia complicating pregnancy. Of the 30 patients studied, 20 cases (66.6%) had a blood pressure between 130/90 mm. Hg. and 150/100 mm. Hg. and oedema and/or albuminuria. These were classified as mild and moderate pre-eclamptics respectively. Ten cases (33.3%) had a blood pressure above 170/120 mm. Hg., oedema and albuminuria along with other associated symptoms. These were classified as severe pre-eclamptics.

Tables IV and V show comparative values of serum proteins, as reported by various authors, in mild and moderate (Table IV) and severe pre-eclampsia (Table V) respectively.

Practically all the cases of anemia in our series were in the 3rd trimester of pregnancy. In the 30 cases (9.4%) of anemia studied, the haemoglobin values ranged between 5.2 gm.% and 7.0 gm.%. Table VI shows comparative values of

TABLE III

Serum Proteins in Delivered Case Reported by Various Authors

Name of Author	Total Serum Protein gm.%	Serum Albumin gm.%	Serum Globulin. gm.%	Alpha 1 gm.%	Alpha 2 gm.%	Beta gm.%	Gamma gm.%
Brown (1956)	6.64	2.53	4.11	0.39	1.03	1.47	1.21
Kulkarni (1960)	5.94	2.61	3.33	0.31	0.70	0.96	1.36
Present series	6.30	2.80	3.51	0.73	0.81	0.96	1.02

TABLE IV

Serum Proteins as Reported by Various Authors in Mild and Moderate Pre-eclampsia

Name of Author	Total Serum Protein gm.%	Serum Albumin gm.%	Serum Globulin gm.%	Alpha 1 gm.%	Alpha 2 gm.%	Beta gm.%	Gamma gm.%
Menon et al (1959)	5.67	2.18	3.49	0.45	0.81	1.03	1.20
Kulkarni et al (1960)	5.20	2.30	2.90	0.24	0.60	0.78	1.28
Kishore & Gupta (1965)	5.44	2.28	3.16	0.50	0.76	0.86	1.08
Present Series	5.49	2.39	3.11	0.58	0.73	0.85	0.95

TABLE V

Serum Protein Values Reported by Various Authors in Severe Pre-eclampsia

Name of Author	Total Serum Protein gm.%	Serum Albumin gm.%	Serum Globulin gm.%	Alpha 1 gm.%	Alpha 2 gm.%	Beta gm.%	Gamma gm.%
Menon et al (1959)	5.78	2.36	3.42	0.43	0.79	1.06	1.14
Kishore & Gupta (1963)	5.49	2.19	3.27	0.45	0.78	0.94	1.10
Present Series	5.52	2.43	3.09	0.52	0.70	0.88	0.97

TABLE VI

Values of Serum Proteins in Cases of Anaemia

Name of Author	Total Serum protein gm.%	Serum Albumin gm.%	Serum Globuiln gm.%	Alpha 1 gm.%	Alpha 2 gm.%	Beta gm.%	Gamma gm.%
Menon et al (1956)	5.18	1.75	3.43	0.56	0.74	0.88	1.24
Kulkarni (1960)	4.94	2.08	2.86	0.26	0.54	0.76	1.34
Present seires	5.12	2.20	2.92	0.57	0.62	0.77	0.95

serum proteins in third trimester of pregnancy associated with anaemia, as reported by various workers.

The effect of age, parity and diet on concentration of serum proteins was studied. No correlation was found between age and concentration of serum proteins in the present series. In our series there was a fall in the concentrations of serum proteins with increasing parity in the third trimester of normal pregnancy and pregnancy associated with anemia or toxaemia, but no change was observed at the time of delivery. In primiparas the mean serum protein values were 6.28 gm.% and 5.60 gm% in women with five or more children. The mean serum albumin values were 2.79 gm.% and 2.42 gm.% and serum globulin values were 3.48 gm.% and 3.18 gm.% respectively. The globulin fractions were also lower in multi-paras as compared to primi-paras.

In third trimester of pregnancy associated with toxaemia the mean values of total serum proteins were 5.57 gm.% in primiparas and 5.40 gm.% in fourth paras. The mean serum albumin values were 2.39 gm.% and 2.30 gm.% and mean serum globulin values 3.18 gm.% and 3.10 gm.% respectively and all globulin fractions were lower in the fourth paras. In pregnancy associated with anemia the mean total serum proteins were 5.10 gm.% in primiparas and 4.92 gm.% in fourth paras, serum albumin values were 2.27 gm.% and 2.14 gm.% and serum globulin values 3.05 gm.% and 2.78 gm.% respectively. The globulin fractions were also observed to be lower

in fourth paras as compared to primiparas.

The patients in the third trimester of pregnancy were divided into vegetarians and non-vegetarians according to diet. In the third trimester of normal pregnancy 30 patients were vegetarians and 20 patients were non-vegetarians. In the third trimester of pregnancy complicated by toxaemia and anemia 18 to 20 patients respectively were vegetarians while 12 and 10 patients respectively were non-vegetarians.

The mean values of serum proteins were slightly higher in non-vegetarians as compared to vegetarians.

Fifty (15.6%) of the cases studied were babies of normal mothers, 10 (3.2%) were babies of toxaemic mothers and 10 (3.2%) babies of anemic mothers.

Table VII shows comparative values of serum proteins in babies of normal mothers in the present study and as reported by Menon *et al* (1959).

Table VIII shows mean values of serum proteins in babies born to mothers with mild and moderate pre-eclampsia in the present series as compared to figures reported by Menon *et al* (1959).

Table VIII shows mean values of serum proteins in babies of mothers with severe pre-eclampsia compared to figures reported by Menon *et al* (1959).

Mean values of serum proteins in babies of anemic mothers were observed to be as follows:—Proteins 4.94 gm.%, S. Albumin 2.56 gm.%., S. Globulin 2.37 gm.%, Alpha 1, 0.43 gm.%, Alpha 2, 0.50 gm.%, beta 0.62 gm.%, and gamma 0.83 gm.%. These values were low as compared to values in babies of normal mothers.

Table X shows concentration of serum proteins in babies according to their birth weight.

TABLE VII

Comparative Values of Serum Proteins in Babies of Normal Pregnancy

Name of Author	Total Serum Protein gm.%	Serum Albumin gm.%	Serum Globulin gm.%	Alpha 1 gm.%	Alpha 2 gm.%	Beta gm.%	Gamma gm.%
Menon et al (1959)	6.74	2.99	3.75	0.45	0.71	1.16	1.43
Present Series	6.25	3.19	3.06	0.62	0.66	0.80	0.96

TABLE VIII

Serum Proteins in Babies of Mild and Severe Pre-eclampsia

Name of Author	Total Serum Protein gm.%	Serum Albumin gm.%	Serum Globulin gm.%	Alpha 1 gm.%	Alpha 2 gm.%	Beta gm.%	Gamma gm.%
Menon et al (1959)	5.53	2.83	2.68	0.32	0.54	0.67	1.15
Present Series	5.56	2.97	2.43	0.50	0.59	0.67	0.73

TABLE IX
Serum Proteins in Babies of Anaemic Mothers

Name of Author	Total Serum Protein gm.%	Serum Albumin gm.%	Serum Globulin gm.%	Alpha 1 gm.%	Alpha 2 gm%	Beta gm.%	Gamma gm.%
Menon et al (1959)	5.57	3.01	2.56	0.33	0.49	0.82	0.92
Present Series	5.51	3.10	2.41	0.49	0.54	0.67	0.72

TABLE X
Serum Proteins in Babies According to Birth Weight

gm.%	Babies of normal mothers		Babies of Toxaemic mothers		Babies of anemic mothers	
	>5 lbs	<5 lbs	>5 lbs	<5 lbs	>5 lbs	<5 lbs
Total S. Protein	6.34	6.03	5.53	5.34	5.01	4.83
S. Albumin	3.21	3.07	3.12	3.29	2.54	2.60
S. Globulin	3.09	2.96	2.41	2.44	2.47	2.23
Alpha 1	0.65	0.60	0.50	0.47	0.48	0.36
Alpha 2	0.67	0.63	0.54	0.57	0.51	0.48
Beta	0.81	0.79	0.66	0.67	0.64	0.60
Gamma	0.96	0.94	0.71	0.72	0.84	0.82

The concentrations of serum proteins were found to be higher in children weighing more than 5 lbs.

Summary and Conclusion

Three hundred and twenty patients, including 70 new born babies, were studied and their serum proteins estimated by the Nesslerization and electrophoretic methods.

1. A steady fall in the total serum proteins was found with the advance of pregnancy.

2. In toxaemia and anemia associated with pregnancy the mean values of serum proteins were lower as compared to mean values in normal pregnancy.

3. There was no effect of age on concentrations of serum proteins but serum proteins showed a tendency to decrease with increase in parity.

4. Concentration of total serum proteins and serum albumins were found to be higher in non-vegetarians as compared to vegetarians but the difference was not marked.

5. Serum protein values were observed to be higher in babies of normal mothers as compared to babies of toxaemic or anemic mothers.

6. Concentrations of serum proteins were higher in babies weighing above 5 lbs as compared to babies weighing less.

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