

# Serum Protein Status in Women of Different Age and Socio-Economic Background and their Neonates

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## ABSTRACT

Serum studies in 153 randomly selected lactating women and their neonates having different socio-economic status, monthly income and age groups were conducted. The results revealed an overall concentration of serum total proteins, albumin, globulin and A:G ratio to be 5.3 vs 5.26 g/dL, 3.18 vs 3.14 g/dL, 2.16 vs 2.11 g/dL and 1.52 vs 1.55, respectively. The total proteins, albumin, globulin and A/G ratio showed non-significant difference between age groups while they showed significant differences between low and high socio-economic status (SES) groups except for A/G ratio which revealed significantly higher values in middle SES group. Co-relations of serum total proteins, albumin and globulin in mothers and neonates were found positive and significant. However, these were found to be non-significant in case of A:G ratio except for serum albumin.

**Key Words:** Serum protein; Women; Neonates; Socio-economic status

## INTRODUCTION

Measurement of serum proteins and fractions reflects the nutritional and health status. Plasma proteins function in the transport of certain substances, maintenance of colloidal osmotic pressure, pH and electrolyte balance.

Blood parameters of neonates are affected by their mothers and serum total protein, albumin and globulin in mother and new born are positively and significantly correlated (Ladipo *et al.*, 1978; Ahmed & Gilani, 1988; Ibrahim *et al.*, 1989).

The information on serum total protein and fractions in mothers as well as the newborns has not been studied thoroughly in Pakistan. The present study was, therefore, carried out to investigate the serum total proteins status of mothers and their neonates and to study the correlation among different blood parameters.

## MATERIALS AND METHODS

The study involved 153 women and their neonates delivered in various hospitals of Faisalabad, Pakistan. Blood samples were collected from peripheral veins of the mothers within 48 h of the delivery. A sample of cord blood was obtained from the neonates in a syringe, removing the needle before drawl. The blood was allowed to clot to get serum, which was transferred to a dry, coloured and stoppered vial and stored at -20°C. The sampling was done during the May-August.

Different parameters included for this study were, determination of total proteins, albumin, globulin and A:G ratio. Serum total proteins were determined following the method described by Oser (1976); whereas, serum albumin was determined by the method of Varley *et al.* (1980). Globulin was calculated by difference, subtracting albumin from total protein. The data thus obtained on these

parameters were subjected to GLM by using Minitab computer software package. The means were compared by Tukey's test for confidence interval by using one way analysis of variance by using same statistical package. Correlation coefficients among different parameters were also worked out by using Minitab (10.2) computer software package (Anonymous, 1994).

## RESULTS AND DISCUSSION

**Serum proteins.** The serum total proteins levels determined within 48 h in mothers during the present study ranged from 3.81 to 7.51g/dL. The levels reported for normal healthy women are 6.0-8.0 g/dL (Benington *et al.*, 1970), 5.8-7.8 g/dL (Passmore & Eastwood, 1979), 7.38 g/dL (Hashmi *et al.*, 1992) and 7.66-7.97 g/dL (Aziz *et al.*, 1988). The variations in plasma proteins are indicative of a condition that alters the tissues responsible for the balance between protein synthesis and catabolism or mechanical loss (Dimopoulos, 1970). In the present study, significantly low levels of serum total protein were observed in 64% of mothers. Benjamin (1978) also reported low serum total protein concentrations during pregnancy. Lower concentration of serum total protein can be attributed to the stress of pregnancy, especially at parturition. The other possibility could be consumption of low quality proteins (Garg *et al.*, 1988). Serum total protein level is directly related to the quality and quantity of dietary proteins (Flodin, 1953). It has been reported to decline under the state of malnutrition (Halliday, 1966; Henry, 1965) and lactation.

Serum total protein levels (Table I) were slightly higher in newborn than in mothers (5.3 vs 5.26 g/dL). Oberman *et al.* (1956) reported that when total serum proteins of individual pairs were compared, the maternal values were higher in 15, the newborn values in six and

almost equal in three pairs. Ladipo *et al.* (1978) also reported that the maternal total proteins were more than the cord serum total proteins, but not to significant levels.

**Table I. Mean serum total protein levels (g/dL) in mothers of different ages and socio-economic status and of neonates**

SES	Age group			Overall mean±SE
	Below 25 years	26-32 years	33 and above years	
<b>Mothers</b>				
Low	4.60c	4.94bc	5.33ab	4.96±0.51B
Middle	5.37ab	4.54c	5.06bc	4.99±0.82B
High	5.77a	5.89a	5.82a	5.83±0.36A
Overall mean±SE	5.25±0.84	5.12±0.65	5.41±0.6	5.26±0.71
<b>Neonates</b>				
Low	4.78c	5.01c	5.41bc	4.98±0.59B
Middle	5.61ab	4.60c	5.08bc	5.10±0.76B
High	5.86a	5.98a	5.99a	5.94±0.40A
Overall mean±SE	5.42±0.80	5.20±0.68	5.49±0.71	5.37±0.05

Different capital letters on overall means for SES and small letters on means of SES x age show significant ( $P<0.01$ ) differences

The serum albumin concentration in mothers during first 48 h of parturition ranged from 2.23-5.51. Bennington *et al.* (1970), Passmore and Eastwood (1979) and Oberman *et al.* (1956) reported serum albumin to range from 3.5 to 5.6 g/dL in normal person. Lower serum albumin levels in mothers at term (1.65 to 3.39 g/dL) were reported by Oberman *et al.* (1956). Hypoalbuminemia has been reported during pregnancy (Benjamin, 1978). The albumin concentration decreases during pregnancy (Dimopoulos, 1970), due to increased protein catabolism under stress condition (Benjamin, 1978). Lower serum albumin concentrations were observed in 57% of mothers. The lower level of albumin observed during the present study positively correlates with the serum total protein levels. This is due to the fact that the albumin concentration has a significant contribution towards serum total proteins levels (Benjamin, 1978). It was observed that mean serum albumin levels were slightly higher in newborn than that in mothers (3.18 vs 3.14 g/dL). Serum albumin has been reported to be higher in infants than in their mothers at term (Moore *et al.*, 1949; Oberman *et al.*, 1956). Similar findings were reported by Knapp and Routh (1949).

The serum globulin concentration observed in mothers during the present study (1.17-3.53 g/dL) tally with the normal range of 1.7-3.53 g/dL reported by Passmore and Eastwood (1979) and 2-3.6 g/dL by Harper (1993). The serum total globulin seldom decreases, though an individual fraction of globulin may decrease due to simultaneous increase in other components (Coles, 1980). Like albumin, mean serum globulin values (Table III) were also slightly

**Table II. Mean serum albumin levels (g/dL) in mothers**

#### of different ages and socio-economic status and of neonates

SES	Age group			Overall mean±SE
	Below 25 years	26-32 years	33 and above years	
<b>Mothers</b>				
Low	2.63c	2.94bc	3.15ab	2.91±0.00B
Middle	3.30ab	2.95bc	3.39a	3.18±0.09AB
High	3.46a	3.53a	2.97bc	3.32±0.00A
Overall mean±SE	3.13±0.52	3.14±0.41	3.14±0.37	3.14±0.42
<b>Neonates</b>				
Low	2.67c	2.96c	3.17bc	2.93±0.09B
Middle	3.41ab	2.99bc	3.34ab	3.25±0.09A
High	3.49ab	3.56a	3.03bc	3.37±0.09A
Overall mean±SE	3.19±0.52	3.18±0.41	3.18±0.37	3.18±0.43

Different capital letters on overall means for SES and small letters on means of SES x age show significant ( $P<0.01$ ) differences

higher in newborns than that of mothers (2.16 Vs 2.11 g/dL). Oberman *et al.* (1956) during a study with maternal-newborn pairing reported higher maternal value in 10 pairs, higher newborn value in eight pairs and no differences in six pairs. It has also been reported that the globulin in newborn infants, is often above the normal adult levels (Longsworth *et al.*, 1945; Knapp & Routh, 1949).

**Table III. Mean serum globulin levels (g/dL) in mothers of different ages and socio-economic status and of neonates**

SES	Age group			Overall mean±SE
	Below 25 years	26-32 years	33 and above years	
<b>Mothers</b>				
Low	1.97c	2.00c	2.18bc	2.05±0.20B
Middle	2.06bc	1.59d	1.66cd	1.78±0.49B
High	2.31bc	2.36b	2.84a	2.51±0.41A
Overall mean±SE	2.12±0.47	1.99±0.39	2.24±0.37	2.11±0.49
<b>Neonates</b>				
Low	2.11bc	2.04bc	2.24bc	2.13±0.29B
Middle	2.20bc	1.61c	1.74c	1.86±0.50B
High	2.36b	2.42b	2.96a	2.58±0.45A
Overall mean±SE	2.23±0.47	2.03±0.40	2.31±0.63	2.16±0.56

Different capital letters on overall means for SES and small letters on means of SES x age show significant ( $P<0.01$ ) differences

The possible cause of higher newborn levels of serum total protein, albumin and globulin observed during the present study lies in the degree of permeability of the placental membrane. The hormone somatomammotrophin causes decreased insulin sensitivity and also decreased utilization of glucose by the mother, hence making larger quantities of glucose available to the foetus, thereby the proteins are being spared from providing energy. The

trophoblast cells lining the outer surface of the villi can also actively absorb certain nutrients from the maternal blood in the placenta. Thereby the measured amino-acid content of foetal blood has been greater than that of maternal blood (Guyton, 1989).

**A:G ratio.** The mean A:G ratio (Table IV) was slightly higher in mothers than that of the neonates ( $1.55 \pm 0.41$  vs  $1.52 \pm 0.40$ ). Mean A:G ratio of mothers was somewhat similar to the ratio ( $> 1.5$ ) reported by Cornelius (1970). However, significantly high A:G ratios were observed in the middle income group. This indicates higher proportions of albumin due to increase in albumin or globulin and reflects immunosuppression.

**Table IV. Mean serum albumin-globulin (A:G) ratio in mothers of different ages and socio-economic status and of neonates**

SES	Age group			Overall mean $\pm$ SE
	Below 25 years	26-32 years	33 and above years	
<b>Mothers</b>				
Low	1.34c	1.47c	1.44c	1.42 $\pm$ 0.10B
Middle	1.69bc	1.98ab	2.01a	1.89 $\pm$ 0.55A
High	1.50c	1.49c	1.09d	1.36 $\pm$ 0.29B
Overall mean $\pm$ SE	1.51 $\pm$ 0.26	1.64 $\pm$ 0.41	1.51 $\pm$ 0.57	1.55 $\pm$ 0.41
<b>Neonates</b>				
Low	1.28c	1.45c	1.43c	1.39 $\pm$ 0.19B
Middle	1.62bc	1.94ab	1.95a	1.83 $\pm$ 0.40A
High	1.48c	1.47c	1.07d	1.34 $\pm$ 0.34B
Overall mean $\pm$ SE	1.46 $\pm$ 0.36	11.62 $\pm$ 0.39	1.48 $\pm$ 0.48	1.52 $\pm$ 0.40

Different capital letters on overall means for SES and small letters on means of SES x age show significant ( $P < 0.01$ ) differences

## CONCLUSIONS

In neonates: serum total protein, albumin and globulin were slightly higher than that of their mothers. Serum total proteins have shown a direct correlation with serum albumin, globulin and A/G ratio. Low levels of serum total protein at low SES are indicative of poor nutritional status.

## REFERENCES

- Ahmad, I. and A.H. Gilani, 1988. Effect of protein-energy malnutrition on serum protein levels in schoolboys. *Pakistan J. Med. Res.*, 277: 192-5.
- Anonymous, 1994. *Minitab 10.2 Release (Minitab for Windows)*. Minitab Inc. 3081 Enterprise drive, State College, PA 16801-3008, 814-238-3280.
- Aziz, S., T.Z. Lodi and T. Hassan, 1988. Serum protein electrophoresis in healthy subjects. *J. Pak. Med. Assoc.*, 27: 18-20.
- Benjamin, M.M., 1978. *Outline of Veterinary Clinical Pathology*, 3rd Ed. The Iowa State University Press, Ames, Iowa.
- Bennington, J.L. Fouty, A. Robert and C. Hougic, 1970. *Laboratory Diagnosis*. Macmillan, Toronto.
- Coles, E.H., 1980. *Veterinary Clinical Pathology*, 3rd Ed. W.B. Saunders Co., Philadelphia.
- Dimopoulos, G.T., 1970. Plasma proteins. In: J.J. Kaneko and C.E. Cornelius (Eds.), *Clinical Biochemistry of Domestic Animals*, 2nd Ed., Vol. 1. Academic Press, N.Y.
- Flodin, N.W., 1953. Amino acids and proteins: their place in human nutrition problems. *J. Agri. Food Chem.*, 20: 222-8.
- Garg, M., S. Thirupuram and K. Shah, 1988. Colostrum composition, maternal diet and nutrition in North India. *J. Tropical Pediatrics*, 34: 79-87.
- Gibson, R.S., 1990. *Principles of Nutritional Assessment*. Oxford University Press, New York.
- Guyton, A.C., 1989. *Text Book of Medical Physiology*. 6th Ed., pp: 981-96. W.B. Saunders Company. West Washington Square Philadelphia. PA 19105.
- Halliday, D. 1966. Body composition in severe infantile malnutrition. Ph.D. Thesis, University of London.
- Harper, 1993. Harper's Biochemistry. 3rd ed. Lang Medical Publications Maruzen Co. Ltd.
- Hashmi, M.I., N. Jaffri, and T. Hashmi, 1992. Electrophoretic fractions of the serum protein. *Pak. J. Med. Res.*, 31 (1): 9-12.
- Ibrahim, K., S.J. Zuberi and S.N. Hussain, 1989. Serum total protein, albumin/globulin and their ratio in apparently healthy population of various ages and sex in Karachi. *J. Pak. Med. Assoc.*, 39: 203-7.
- Knapp, E.L. and J.I. Routh, 1949. Electrophoretic studies of plasma proteins in normal children. *Paed.*, 4: 508-14.
- Ladipo, O.A., L.S. Salimonu and B.O. Osunkoya, 1978. Correlation of birth weight with foeto maternal immunoglobulin, total protein and albumin profile. *African J. Med. and Med. Sci.*, 7: 211-7.
- Longsworth, L.G., R.M. Curtis and R.H. Pembroke, 1945. Electrophoretic analysis of maternal and fetal plasma and sera. *J. Clin. Investigation*, 24: 46.
- Moore, D.H., D.U. Pan and G.L. Buxton, 1949. Electrophoretic study of maternal, fetal, and infant sera. *American J. Obst. and Gynec.*, 57: 312-22.
- Oberman, J.W., O. Karikor, B.S. Gregory, G. Frederic, M.D. Burke, S. Ross and E.C. Rice, 1956. Electrophoretic analysis of serum proteins in infants and children: Normal values from birth to adolescence. *The New England J. Med.*, 255: 743-52.
- Oser, B.L. 1976. *Hawk's Physiological Chemistry*. McGraw Hill publ. Co. New Delhi, India.
- Passmore, R. and M.A. Eastwood, 1979. *Davidson and Passmore Human Nutrition and Dietetics*. 8th Ed. The English Language Book Society, Churchill Livingstone, UK.
- Varley, H., A.H.G. Owenlock and M. Bell, 1980. *Practical Clinical Biochemistry*. Vol. 1. Williams and Heinmann Medical books Ltd. London.

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