A STUDY ON SERUM PROTEINS IN DIABETIC AND NON-DIABETIC PREGNANT AND MENOPAUSAL WOMEN OF TWO SOCIO-ECONOMIC STATUSES

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SUMMARY: Present study was carried out on 160 women belonging to Faisalabad region (Pakistan) including diabetic and non-diabetic and as well as pregnant and menopausal women in equal number. These women were randomly selected from those coming to various hospitals of the city. Blood samples from these subjects were collected with and without anticoagulant to obtain plasma and serum for further studies. Study revealed serum total proteins to be 4.49, 5.55, 4.73 and 5.31 g/100 ml and albumin 3.35, 4.21, 3.74 and 3.80 g/100 ml in pregnant, menopausal, diabetic and non-diabetic groups, respectively. Serum globulins were 1.15, 1.34, 0.99 and 1.50 g/100 ml and serum immunoglobulins were 130.20, 150.95, 92.15 and 189.96 zst-units, respectively. Plasma fibrinogen was 292.68, 497.50, 353.66 and 435.00 mg/100 ml in four groups. Comparison of different serum proteins between diabetic and non-diabetic women revealed significant ($p<0.05$) difference only in immunoglobulins which were higher ($p<0.05$) in non-diabetic women, while comparison between pregnant and menopausal women revealed significant ($p<0.05$) difference in plasma fibrinogen concentration which was higher in menopausal women. When diabetic pregnant, diabetic menopausal, non-diabetic pregnant and non-diabetic menopausal women were compared, values for serum total proteins, albumin, globulins, immunoglobulins and fibrinogen were higher ($p<0.05$) in non-diabetic menopausal subjects. Non-significant difference was observed in serum total proteins and fractions between women of two socio-economic statuses (SES) in each group.

Key Words: Diabetes, pregnancy, menopause, proteins.

INTRODUCTION

Overall body protein status is usually assessed through the levels of total proteins and albumin in serum (15). Concentration of serum total proteins and albumin is reported to be higher in the first month of gestation and then decreases until parturition. Serum globulins are higher during the second month of gestation but it decreases later (9). The drop in serum protein during pregnancy occurs from 7.3 g/100 ml in non-pregnant to about 6.8 g/100 ml in third trimester (4). The drop in serum protein is mainly due to accretion of protein by the foetus (13). Therefore, an additional supply of protein about 1000 g's for the entire pregnancy (14) particularly

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for diabetic mother is needed (2). Similarly, studies on diabetic and non-diabetic menopausal women showed significant differences in plasma protein, particularly in fibrinogen and urinary albumin in diabetic versus non-diabetic persons (10). Fibrinogen is reported to be important in maintaining pregnancy. Its level must be at least 60 mg/dl during gestation and 150 mg/100 ml during labor (11). It has been observed that level of plasma fibrinogen is higher in menopausal compared to pre-menopausal stage. Immunoglobulin status increases during pregnancy (8). It has also marked effect on pregnancy and delivery (19).

The level of serum proteins and its fractions in diabetic and non-diabetic pregnant and menopausal women living under poor economic conditions is lower than normal. Present project was, therefore, aimed to study the serum total proteins and fractions in diabetic and non-diabetic, pregnant and menopausal women, living under different socio-economic statuses.

MATERIALS AND METHODS

Diabetic and non-diabetic, pregnant and menopausal patients coming to Faisalabad and Punjab City Hospitals were randomly selected for this study (Table 1). Blood samples were collected from each subject and separated into tubes, one of which was anticoagulated to obtain plasma. The other was allowed to coagulate and produce serum to study proteins and their fractions.

Serum total protein was determined by Biuret method and albumin by bromocresol green dye binding method (18). Serum globulin was estimated by subtracting albumin from total protein and results were expressed in g globulins/100 ml of samples. Serum immunoglobulins were determined using selective turbidity procedure by $ZnSO_4$ (12). Plasma Fibrinogen was determined by Schalm method using refractometer (3).

Table 1: Experimental design.

Socio-economic status	Diabetic		Non-diabetic	
	Pregnant (n)	Menopausal (n)	Pregnant (n)	Menopausal (n)
Low	20	20	20	20
High	20	20	20	20
Total	40	40	40	40

Data thus obtained were analyzed by using analysis of variance technique and means were compared by using DMR test on personal computer using SAS 6.2.1 statistical package (1). Correlation coefficients among different parameters were also worked out.

RESULTS AND DISCUSSION

In the study, both diabetic and non-diabetic groups contained pregnant and menopausal women and vice versa. Study on serum revealed an overall mean serum total proteins of 4.49, 5.55, 4.73 and 5.31 g/100 ml in pregnant, menopausal, diabetic and non-diabetic women, respectively (Tables 2 and 3). The difference between diabetic and non-diabetic and also between pregnant and menopausal women was non-significant (Tables 2 and 3). However, serum total proteins were relatively higher in menopausal women which confirms previous findings of an increase in serum protein with age (6), and decrease during pregnancy (16). Present findings also suggest lower serum total proteins during pregnancy than after delivery values as reported by Tabassum *et al.* (17). It may be possible that relative increase in serum total protein occurs after delivery, owing to loss of plasma. When four groups, i.e., diabetic pregnant, diabetic menopausal, non-diabetic pregnant and non-diabetic menopausal, were compared, serum total proteins revealed higher ($p<0.05$) values in non-diabetic menopausal women (Table 2). This suggests that pregnancy has suppressing affect on serum protein values to that of menopausal age. Relatively lower serum proteins in pregnant diabetic women suggest that pregnancy along with diabetes has more suppressing effect on serum protein concentration, which may partly be due to sharing of serum proteins by neonate in utero. The pattern was similar when these groups were compared in each low and high socio-economic status. Non-significant difference between women of different socio-economic status in each of four groups (Table 2) suggests that serum protein in these subjects is not influenced by dietary intakes. Similarly, non-significant difference after delivery between women of different socio-economic status in the same locality has already been reported (17). At menopausal age, serum total proteins were higher ($p<0.05$) in non-diabetic than diabetic women of low socio-economic status (Table 3),

Table 2: Serum total protein (g/100 ml), albumin (g/100 ml), globulins (g/100 ml) and immunoglobulins (zst-units) in different groups of women (means±SD).

	Diabetic		Non-diabetic	
	Pregnant	Menopausal	Pregnant	Menopausal
Total protein				
Low SES	4.28±1.22 b^{B}	5.28±0.66 a^{AB}	4.69±1.19 ^{AB}	5.76±0.756 ^{A}
High SES	4.69±1.19 ^{B}	4.72±1.55 ^{B}	4.01±1.02 b^{B}	6.45±1.57 a^{A}
Mean	4.47±1.14 ^{B}	5.01±1.97 ^{B}	4.51±1.42 b^{B}	6.10±1.25 a^{A}
Overall mean	4.73±1.19		5.31±1.53	
Albumin				
Low SES	3.236±1.07 b^{B}	4.253±1.01 a^{A}	3.41±0.84 ^{AB}	3.74±0.97 ^{AB}
High SES	3.77±1.35 ^{B}	3.82±1.25 ^{B}	2.97±0.27 b^{B}	5.10±1.41 a^{A}
Mean	3.491±1.21 ^{BC}	4.01±1.12 ^{AB}	3.22±0.91 b^{C}	4.41±1.37 a^{A}
Overall mean	3.74±1.19		3.80±1.31	
Globulin				
Low SES	1.04±0.65	1.13±0.81	1.55±1.3	2.02±1.24
High SES	0.912±0.80	0.9±0.60	1.12±0.98	1.35±0.57
Mean	0.981±0.71 ^{B}	1.995±0.70 ^{B}	1.32±1.14 ^{AB}	1.68±1.00 ^{A}
Overall mean	0.99±0.70		1.50±1.08	
Immunoglobulin				
Low SES	88.23±47.33 ^{D}	104.40±56.99 ^{C}	174.61±77.84 ^{B}	240.36±68.55 A^{A}
High SES	83.83±51.16 ^{B}	92.52±54.07 ^{B}	178.34±119.9 ^{A}	166.52±67.77 B^{A}
Mean	86.14±48.24 ^{B}	98.46±54.41 ^{B}	176.48±93.37 ^{A}	203.44±76.39 ^{A}
Overall mean	92.15±51.08 ^{B}		189.96±85.31 ^{A}	

Means of four groups of women and overall means, having superscript capital letters in a row are significant at $p<0.05$.

Means with small letters in a row and capital letters in a column, between two groups of women are significant at $p<0.05$.

while difference was relative in women of high socio-economic status which probably suggests dietary differences in two classes of women suffering from diabetes.

Serum albumin concentrations of diabetic, non-diabetic, pregnant and menopausal women were 3.74, 3.80, 3.35 and 4.21 g/100 ml, respectively (Tables 2 and 3). Similar to serum total proteins, albumin was also higher ($p<0.05$) in menopausal women. Almost a similar pattern was observed in serum albumin concentration in women of each socio-economic status as for total proteins. It is well known that albumin concentration contributes significantly to alterations of serum total protein level (3). Present values in pregnant women (3.35 g/100ml) were different as reported for Iranian women at pre-partum of 3.63 g/100ml (7). As pregnant women group of the present study included both diabetic and non-diabetic women in equal number, the difference is quite obvious. Similar to serum total proteins, non-significant difference was observed in serum albumin levels between women of low and high socio-economic status in each of three groups but in menopausal non-diabetic patients albumin level was higher ($p<0.05$) in women of high socio-economic status (Tables 2 and 3). This probably suggests nutritional contribution in these subjects.

Serum globulins during present study in diabetic, non-diabetic, pregnant and menopausal women were 0.99, 1.50, 1.15 and 1.34 g/100 ml, respectively (Tables 2 and 3). However, all these values were lower than 2.16 g/100 ml globulins after delivery in women of same locality (17). This probably suggests an activation of immune mechanisms leading to higher levels of globulins (7).

Table 3: Serum total protein (g/100 ml), albumin (g/100 ml), globulins (g/100 ml) and immunoglobulins (zst-units) in different groups of women (means±SD).

	Pregnant		Menopausal	
	Diabetic	Non-diabetic	Diabetic	Non-diabetic
Total protein				
Low SES	4.28±1.22	4.69±1.19	5.28±0.66 b	5.76±0.75 a
High SES	4.69±1.19	4.01±1.02	4.72±1.55	6.45±1.57
Mean	4.47±1.14	4.51±1.42	5.01±1.97 b	6.10±1.25 a
Overall mean	4.49±1.26		5.55±1.33	
Albumin				
Low SES	3.236±1.075	3.41±0.84	4.253±1.01	3.74±0.97 B
High SES	3.77±1.35	2.97±0.27	3.82±1.25	5.10±1.41 A
Mean	3.491±1.21	3.22±0.91	4.01±1.12	4.41±1.37
Overall mean	3.35±1.07		4.21±1.25	
Globulin				
Low SES	1.04±0.65	1.55±1.3	1.13±0.81	2.02±1.24
High SES	0.912±0.80	1.12±0.98	0.9±0.60	1.35±0.57
Mean	0.981±0.71 b	1.32±1.14 a	0.995±0.70	1.68±1.00
Overall mean	1.15±0.95		1.34±0.92	
Immunoglobulin				
Low SES	88.23±47.33	174.61±77.84	104.40±56.99	240.36±68.55
High SES	83.83±51.16	178.34±119.9	2.52±54.07	166.52±67.77
Mean	86.14±48.24 b	176.48±93.37 a	98.46±54.41 b	203.44±76.39 a
Overall mean	130.20±85.99		150.95±84.33	

Means with small letters in a row between two groups of women are significant at $p<0.05$.

Further, there may be a relative increase in globulins after delivery as indicated for total serum protein concentrations. Like albumin, serum globulins were also higher in menopausal non-diabetic compared to menopausal diabetic and pregnant diabetic women. This suggests that diabetes has adverse effects on serum globulins' concentration. Serum globulins showed non-significant changes in women of different socio-economic status (Tables 2 and 3), while previously higher globulins in women of high socio-economic status after delivery were observed (17) which probably suggest that changes in globulins become pronounced after delivery.

Serum immunoglobulins concentrations were 92.15, 189.96, 130.20 and 150.95 zst-units in diabetic, non-diabetic, pregnant and menopausal women, respectively (Tables 2 and 3). Lower IgG1 concentration during pregnancy has also been reported for Iranian women (8). However, values were lower in diabetics which suggest a more intense influence of diabetes on immune status (Table 2).

Fibrinogen concentration in diabetic, non-diabetic, pregnant and menopausal women was 353.66, 435.00, 292.68 and 497.70 mg/100 ml, respectively (Tables 2 and 3). Fibrinogen was also higher ($p<0.05$) in menopausal patients compared to other stressed pregnancy and diabetes women. Similarly higher fibrinogen levels have been reported ($p<0.05$) in women after menopause (5) while fibrinogen levels were higher in non-diabetic menopausal women ($p<0.05$) compared to non-diabetic and diabetic pregnant patients. Higher ($p<0.05$) fibrinogen in non-diabetic menopausal than non-diabetic pregnant and diabetic pregnant women was similar to other proteins (Table 2). Present findings suggest that fibrinogen concentration is influenced by

Table 4: Plasma fibrinogen (mg/100 ml) in different groups of women (means±SD).

P. fibrinogen	Diabetic		Non-diabetic	
	Pregnant	Menopausal	Pregnant	Menopausal
Low SES	345.45±163.50 ^{B}	330.00±188.86 ^{B}	270.00±149.44 b^{B}	650.00±521.22 a^{A}
High SES	240.00±195.51 ^{B}	500.00±355.90 ^{A}	310.00±185.32 ^{AB}	510.00±296.10 ^{A}
Mean	295.24±182.97 ^{B}	415.00±290.78 ^{AB}	290.00±165.115 b^{B}	580.00±418.77 a^{A}
Overall mean	353.66±246.07		435.00±346.82	
P. fibrinogen	Pregnant		Menopausal	
	Diabetic	Non-diabetic	Diabetic	Non-diabetic
Low SES	345.45±163.50	270.00±149.44	330.00±188.86	650.00±521.22
High SES	240.00±195.51	310.00±185.32	500.00±355.90	510.00±296.10
Mean	295.24±182.97	290.00±165.115	415.00±290.78	580.00±418.77
Overall mean	292.68±172.32 ^{B}		497.50±360.49 ^{A}	

Means of four groups of women and overall means, having superscript capital letters in a row are significant at p<0.05.

Means with small letters in a row and capital letters in a column, between two groups of women are significant at p<0.05.

pregnancy, while diabetes has little if any effect on fibrinogen level.

Correlation between serum total protein and fractions was almost similar in all four groups of women, i.e., pregnant (diabetic and non-diabetic), menopausal (diabetic and non-diabetic), diabetic (pregnant and menopausal) and non-diabetic (pregnant and menopausal).

It can be concluded from the present study that immunoglobulins and serum proteins decrease in women suffering from diabetes, while serum total proteins, albumin, and plasma fibrinogen increase and become high at menopausal age compared to pregnant women.

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