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Association between Serum Fibrinogen Level in Type-2 Diabetes Mellitus Patient with or without Microvascular Complication

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Abstract
Background- Various studies have shown that Hemostatic disturbance, including high fibrinogen levels, are associated with coronary heart disease in patients with diabetes. However relation between fibrinogen level and microangiopathic complications is not clear. So we choose this sudy.
Aims and objectives-To correlate the association of serum fibrinogen level with different clinical parameters and complication of diabetes. To correlate the level of serum fibrinogen with glycemic control (HbA_1C).To correlate the association of serum fibrinogen level with duration of Diabetes mellitus. To correlate the association of serum fibrinogen level with different biochemical parameters. To compare the serum fibrinogen level in patient of type-2 DM with oral hypoglycemic agent and insulin therapy.
Material and methods – All the patients were diagnosed case of Type 2 diabetes mellitus patient or newly detected Type 2 diabetes mellitus patient with or without microvascular complications (age group 25-85 yrs either sex) which admitted J.A. Group of Hospitals Gwalior M.P. and who attend Medicine OPD were included. - Total no. of 88 patients were selected randomly divided in three groups. Group A – (n=34) type-2 diabetes mellitus with microvascular complication, Group B– (n= 26 type-2 diabetes mellitus without microvascular complication, Group C- (n=28) non diabetic healthy control.
Results - Maximum number of patients in study were between 40-60 yrs age group. Mean age was 53±13, 48±15 and 49±12 among group A, B and C.M:F ratio was almost equal in all three group was 2.9:2, 3.2:2 & 2.7:2 in group A,B & C respectively. Most common presenting symptom was tingling & numbness (41.17%) followed by polyuria (38.23%) and blurring of vision (29.41%) in group A patient while polyuria (29.92%) was presenting symptom of group B. Most common microvascular complication found was nephropathy followed by retinopathy and neuropathy in type-2 DM patient. Mean duration of diabetes was 5.5±3.14 yrs and 2.8±1.8 yrs among group A and B respectively. Micro vascular complication (nephropathy, retinopathy & neuropathy) increased with duration of diabetes. Serum fibrinogen level was found higher in Type-2 DM patient with microvascular complication as compared to non diabetic control (515±138.7, 308.53±52.65 p value <0.003).Type-2 DM without microvascular complication group patients also had higher fibrinogen level in comprasion of non diabetic control (437±137, 308.53±52.65 p value-0.002).Serum fibrinogen level was more elevated in type-2 DM patients with microvascular complication groups as compared to patients without microvasuclar complication (515±138.7 vs 437±137, p value 0.02).No statistically significant positive correlation was found between serum fibrinogen and age, gender and duration of diabetes.. Serum fibrinogen level was higher in overweight (23-27.49) patients as compared to the normal patient (18.5-22.94) in all groups. A positive correlation was seen with BMI. Serum fibrinogen level was linearly related to urine albumin excretion rate (p <0.001). A significant positive correlation was observed between hyperfibrinogenemia and hypercholesterolemia (p value <0.01) but did not found any correlation with LDL, HDL and TG. Glycosylated hemoglobin (HbA1c) was positively correlated with fibrinogen level. A majority of type-2 DM patients had poor diabetic control and had high fasting and post prandial blood sugar. No significant linear relationship was seen between serum fibrinogen and FBS & PPBS. Serum fibrinogen level was higher in patient who taking insulin.
Conclusion- On the basis of observations of present study its concluded that Serum fibrinogen level was found to be higher in Type-2 diabetic patients as compared to non diabetic controls and further increase in patients who having microvascular complication.

Keywords: Serum Fibrinogen Level, Type-2 Diabetes Mellitus, Microvascular Complications.

1. Introduction
Diabetes Mellitus is the most common metabolic disorder characterized by a series of hormone induced metabolic abnormalities and long term complications. Diabetes mellitus is a common

medical disease with about 30 million people affected all over the world. Overall prevalence of diabetes in most adult populations is 2-5%. It is a leading cause of death in many developed countries. The relation between specific and nonspecific determinants of mortality in diabetes is dominated by the incremental risk of microvascular complications in the form diabetic nephropathy, diabetic retinopathy and neuropathy and also changes like dermopathy and myopathy ETC. The exact pathogenesis of microvascular complications in diabetes mellitus (DM) is unknown. Oxidative stress, activated renin-angiotensin system (RAS), hyperglycemia, advanced glycosylation end-products (AGE), and oxidized low-density lipoproteins are factor contributing to initiation and progression of endothelial inflammation, ultimately leading to diabetic vascular complications. Diabetes is associated with a hypercoagulable state, possible related to hypreglycemia. Plasma fibrinogen is a major determinant of blood viscosity and correlates with plasma viscosity in diabetic patients. Various studies have shown that hemostatic disturbance, including high fibrinogen levels, are associated with coronary heart disease in patients with diabetes. However relation between fibrinogen level and microangiopathic complications is not clear. So we choose this sudy.

Aims and Objectives-To correlate the association of serum fibrinogen level with different clinical parameters and complication of diabetes. To correlate the level of serum fibrinogen with glycemic control (HbA_1C).To correlate the association of serum fibrinogen level with duration of Diabetes mellitus. To correlate the association of serum fibrinogen level with different biochemical parameters. To compare the serum fibrinogen level in patient of type-2 DM with oral hypoglycemic agent and insulin therapy.

Material And Methods-All the patients were diagnosed case of Type 2 diabetes mellitus patient or newly detected Type 2 diabetes mellitus patient with or without microvascular complications (age group 25-85 yrs either sex) which admitted J.A. Group of Hospitals and who attend Medicine OPD were included. Inclusion criteria-Type 2 diabetes mellitus patient with microvascular complications (retinopathy, nephropathy and neuropathy) Type 2 diabetes mellitus patient without microvascular complications Exclusion criteria-Coronary artery disease, Cardiomyopathy, Malignancy, Pregnancy, Crebrovascular accident, Patients with chronic liver dysfunction, Chronic alcoholics, Other causes of albuminuria: acute febrile illness, severe exercise, orthostatic proteinuria and cardiac failure is excluded from the study and patient who did not give consent. Sample Size - Total no. of 88 patients were selected randomly divided in three groups. Group A – (n=34) type-2 diabetes mellitus with microvascular complication, Group B– (n= 26 type-2 diabetes mellitus without microvascular complication, Group C- (n=28) non diabetic healthy control. Patient selection-Cases of diabetes diagnosed based on the ADA-WHO diagnostic criteria for diabetes mellitus.

Stage	Fasting Plasma Glucose Test (FPG)	Casual Plasma Glucose Test	Oral Glucose Tolerance Test (OGTT)
Diabetes	FPG greater than or equal to 126 mg%	Casual Plasma Glucose greater than or equal to 200 mg% plus symptoms	Two-hour plasma glucose (2hPG) greater than or equal to 200 mg%
Impaired Glucose Homeostasis	Impaired Fasting Glucose (IFG) = FPG greater than or equal to 110 and less than 126 mg%		Impaired Glucose Tolerance (IGT) = 2h PG greater than or equal to 140 mg% and less than 200 mg%
Normal	FPG less than 110 mg%		

Method-Informed consent was taken from all the patients. Each patient was subjected to detailed history and clinical examination including age of the patient, sex, duration of diabetes and existence of symptoms numbness, hyperesthesia and any visual problem, history of taking any anti-diabetic medication & complete physical examination including fundus examination and CNS examination with different neuropathy. All routine investigations done in department of Pathology & Biochemistry, G.R. Medical College, Gwalior including: Complete blood count, Fasting plasma glucose, Post prandial plasma glucose, Serum lipid profile, Renal function test, Urine - R/M, 24hr urinary protein/urine for micro albumin,HbA_1C,ECG .Serum fibrinogen level Measured by modification of Clauss method, Fundus examination was done.
Data Analysis -Data analysis was done by software EPICAL and EPIMAX, mean, standard deviation, and p value are measured in all statics by student t test and anova t test. P value <0.05 was considered significant.

OBSERVATIONS

The present study was a randomized case control study. Total 88 patients were included divided in 3 group-Group A-consisting of Type-2 DM with microvascular complication (n=34), Group B-consisting of Type-2 DM without microvascular complication(n=26),Group C- non-diabetic control (n=28)

Table 1: Table showing Age wise distribution of cases

Age Group	Group A (n=34)	Group B (n=26)	Group C (n = 28)
< 40 yrs	4 (11.76%)	9 (34.61%)	7 (25%)
40-60 yrs	23 (67.64%)	12 (46.15%)	14 (50%)
> 60 yrs	7 (20.50%)	5 (19.23%)	7 (25%)
Total	**34 (100%)**	**26 (100%)**	**28 (100%)**

Above table shows maximum number of patients were found in age group between 40-60 yrs in Group A, B & C which are 67.64% (23), 46.15% (12) and 50% (14) respectively. Mean age was 53±13, 48±15 and 49±12 in group A, B & C respectively.

Table 2: Table showing Sex wise distribution of cases

Sex	Group A (n=34)	Group B (n=26)	Group C (n = 28)
Male	20 (55.5%)	16 (54.4%)	16 (57.2%)
Female	14 (45.5%)	10 (41.6%)	12 (42.8%)
Total	**34 (100%)**	**26 (100%)**	**28 (100%)**

Above table shows male was slightly predominant over female in each group. Male female ratio is 2.9:2, 3.2:2 & 2.7:2 in Group A, B & C respectively.

Table 3: Table showing percentage of clinical symptom in both group

Symptoms	Group A (Type-2 DM with micro-vascular complication)(n=34)		Group B (Type-2DM without microvascular complication)(n=26)	
	n = no. of patients	Percentage (%)	n = no. of patients	Percentage (%)
Polyurea	13	38.23	7	29.92
Polydypsia	3	8.82	3	11.53
Polyphagia	6	17.64	2	7.69
Tingling & numbness	14	41.17	0	0
Blurring of vision	10	29.41	0	0
Skin manifestation	3	8.82	1	3.8
Other	10	29.41	16	61.33

Table 4: Distribution of patients according to various microvascular complication in Type-2 DM (Group A n=34)

Complication	Alone	combination with other microvascular complication	Total
Nephropathy	8 (23.5%)	15 (44.11%)	**23 (67.64%)**
Retinopathy	6 (17.64%)	15 (44.11%)	**21 (61.76%)**
Neuropathy	2 (5.8%)	12 (35.29%)	**14 (41.11%)**

table showing that out of 34 patients of type-2 DM with microvascular complication commonest complication was nephropathy present in 23(67.64%), followed by retinopathy 21(61.76%) and neuropathy 14 (41.11%)

Table 5: Table showing relationship of microvascular complication with duration of diabetes

Duration of diabetes	Group A (n=34)(Type-2DM with microvascular complication)					
	Nephropathy		Retinopathy		Neuropathy	
	n=No.	%	n=No.	%	N=No.	%
<5yr(n=13)	7	53.8	7	53.8	4	32.7
5-10yrs(n=17)	12	70.55	10	58.8	7	41.12
>10yrs(n=4)	4	100	4	100	3	75

Above table showing that microvascular complication (nephropathy, retinopathy & neuropathy) were progressively increase with duration of diabetes. In more than 10 yrs duration of diabetes group 100% patients had nephropathy & retinopathy and 75% patient had neuropathy. Mean duration of diabetes was 5.5±3.4yrs.

Table 6: Table showing distribution of patient according to serum fibrinogen level in different group

S. fibrinogen level (mg/dl)		Group A (n=34)	Group B (n=26)	Group C (n=28)
Normal		5 (14.7%)	7 (26.9%)	28 (100%)
Elevated		29(85.29%)	19(73.07%)	0
	400-600	20 (58.8%)	17 (65.4%)	0
	>600	9 (26.5%)	2 (7.7%)	0
Total		**34 (100%)**	**26 (100%)**	**28 (100%)**

Above table showing out of 34, 29(85.29%) patients had elevated fibrinogen level and significant fibrinogen (>600) were elevated in 9(26.5%) in group A. In Among group B out of 26, 19(73.07%) patients had elevated fibrinogen level and significant level (>600) were elevated only in 2(7.7%) patients. Among group C all patients had serum fibrinogen level normal. (p value-<0.05)

Table 7: Table showing mean fibrinogen level in different groups

	Group A (n=34)	Group B (n=26)	Group C (n=28)	P value
Fibrinogen level (Mean±SD)	515±138.7	437±137	308.53±52.65	**.002**

Above table shows serum fibrinogen level was elevated in both group A & B compare to group C in which serum fibrinogen level was normal. Among group A serum fibrinogen level was more elevated compare to group B. Which is statistically significant (p value <0.05).

Table 8: Table showing relationship of serum fibrinogen level in patient of nephropathy (n=23)

Serum fibrinogen (mg/dl)	Albuminuria (mg/L)	
	30-300 (Incipient nephropathy)	>300 (Overt nephropathy)
Normal (n=3)	2(66.6%)	1(33.3%)
Elevated (n=20)	14(70%)	6(30%)
400-600	10(71.42%)	3(50%)
>600	4(28.5%)	3(50%)

Above table showing out of 23 patients of nephropathy 3 had normal fibrinogen level and 20 had elevated level. Significant fibrinogen level(>600 mg/dl) was seen in 50% patients of overt nephropathy and 28.5% patients of incipent nephropathy patients.

Table 9: Table showing Mean Fibrinogen level with albumin excretion rate (mg/L)

	n= No. of patients	Fibrinogen level (mean+SD)	P value
< 30 (Normal Albuminuria)	37	439.7±135.15	**0.04**
30-300 (Microalbuminuria)	16	525.7±145.4	
> 300 (Macroalbuminuria)	7	545.7±112.2	

Above table show serum fibrinogen level progressively increase with albumin excretion rate which was statistically significant (P value <0.05).

Table 10: Relationship of nephropathy with other complication (Group A)

Albuminuria (mg/L)	With Retinopathy	With Neuropathy	Alone	Total
30-300 (incipient Nephropathy)	9 (56.3%)	6 (37.5%)	1 (6.2%)	**16 (100%)**
>300 (overt nephropathy)	3 (42.9%)	3 (42.9%)	1 (14.3%)	**7 (100%)**

Above table show type-2 diabetes mellitus with incipient nephropathy patient mostly associated with retinopathy 56.3% (9) followed by neuropathy 37.5% (6).While type-2 diabetes mellitus with overt nephropathy patient equal associated with retinopathy and neuropathy 42.9% (3) each.

Table 11: Table showing age group wise serum fibrinogen level in different group

Age Group	Group A (Serum fibrinogen level mg/dl)			Group B (Serum fibrinogen level mg/dl)		
	Normal (n=5)	Elevated (n=29)	Total (n=34)	Normal (n=7)	Elevated (n=19)	Total (n=26)
<40yrs	2 (50%)	2(50%)	**4**	3(33.3%)	6 (66.7%)	**9**
40-60yrs	2 (8.6%)	21(91.3%)	**23**	3(25%)	9(75%)	**12**
>60yrs	1 (14.28%)	6 (85.72%)	**7**	1(20%)	4(80%)	**5**

table showing 29 out of 34 patient and 19 out of 26 patient in among group A & B respectively had elevated fibrinogen level, and maximum number of patient who had elevated fibrinogen level was 91.3% found in age group between 40-60yrs in group A and 80% found in more then >60 yrs age group patient in group B

Table 12: Table showing relationship of mean fibrinogen with age in different group

Age group	Group A (Fibrinogen level Mean ± SD) (n=34)	Group B (Fibrinogen level Mean ± SD) (n=26)	Group C (Fibrinogen level Mean ± SD) (n=28)
<40yrs	(4) 495±272.6	(9) 454.7±186.4	(7) 313.9±29.15
40-60yrs	(23) 513±118	(12) 418±124.07	(14) 311.6±32.0
>60yrs	(7) 532.4±129.5	(5) 437±55.8	(7) 297.14±95
P value	**0.76**	**0.84**	**0.66**

Table showing among group A serum fibrinogen level was maximum found in >60yrs age group patients and fibrinogen level progressively increase with age. But level of difference was not significant.(p value->0.05)Among group B & C maximum serum fibrinogen level is found in <40yrs age group.

Table 13: Table showing relationship of mean fibrinogen with sex in different group

Sex	Group A (Fibrinogen level Mean ± SD) (n=34)	Group B (Fibrinogen level Mean ± SD) (n=26)	Group C (Fibrinogen level Mean ± SD) (n=28)
Male	(20) 501.3±145.3	(16) 458±132	(16) 307.7±65.8
Female	(14) 513±179	(10) 395.7±142.5	(12) 309.7±29.9
P value	**0.83**	**0.26**	**0.92**

Above table show among group A & C serum fibrinogen level was more in female than the male and among group B serum fibrinogen level was more in male than the female which was statistically not significant (P value >0.05).

Table 14: Table showing relationship of serum fibrinogen level with duration of diabetes

Duration of diabetes	Group A (n=34)			Group B (n=26)		
	n= No.	Fibrinogen (mean ± SD)	P value	n= No.	Fibrinogen (mean ± SD)	P value
<5yrs	13	499.7± 105	0.64	22	428.4± 147	**0.51**
5-10yrs	17	525.8± 175		2	464± 11.34	
>10yrs	4	518.8± 35		2	499± 71.41	

Above table show in among group A maximum serum fibrinogen level (525.8±175) was found in 5-10yrs duration of diabetes group and among group B maximum serum fibrinogen level (499±71.45) was found in >10yrs duration of diabetes group. fibrinogen level increase with duration of diabetes but Level of difference was not significant.(p value->0.05)

Table 15: Table showing relationship of serum fibrinogen level with BMI in different group

BMI (kg/m^2)	Group A (n=34)		Group B (n=26)		Group C (n=28)	
	Fibrinogen (mean±SD)	P value	Fibrinogen (mean±SD)	P value	Fibrinogen (mean±SD)	P value
Normal (18.5-22.99)	(11) 433±139	**0.01**	(20) 416.9±126.7	**0.002**	(22) 299±54.65	**0.05**
Over weight (23-27.49)	(19) 564±129		(6) 492.2±166.7		(6) 343±24.74	
Obese (>27.5)	(4) 506.8±82		0		0	

Above table showing serum fibrinogen level was high in overweight patient than normal patient (564±129, 433±139, p value - 0.01) and (492.2±166.7, 416.9±126.7, p value - 0.002) in group A & B respectively. Positive correlation was found between serum fibrinogen level and BMI in all groups. (p value - <0.05).

Table 16: Table showing relationship of serum fibrinogen level with serum lipid profile in total diabetic patients (Group A+B)

		n= No. of patients	Fibrinogen level (mean+SD)	P value
Total cholesterol	< 200	23	381.7±118.1	**0.005**
	> 200	37	541.1±121.7	
TG	< 150	37	448±143	0.08
	> 150	23	518.1±159	
LDL	< 130	46	475±156	0.96
	> 130	14	473±143	
HDL	< 45	37	465±154	0.31
	> 45	23	503.9±120.7	

Above table shows serum fibrinogen level was significantly associated with total cholesterol (p value <0.05). But no significant association was found between serum fibrinogen level and TG, LDL & HDL.

Table 17: Table showing relationship of serum fibrinogen with glycosylated haemoglobin

HBA_1C (%)	Group A (n=34)			Group B (n=26)		
	n= No.	Fibrinogen (mean ± SD)	P value	n= No.	Fibrinogen (mean ± SD)	P value
6.5-9	8	413.4± 124.8	**0.05**	7	372.8± 62.49	**0.04**
9-12	14	514± 99		12	409.33± 109.6	
>12	12	567.5± 173.4		7	538.6± 184.6	

Above table showing maximum number of patient have HbA_1C level between 9-12% in both group A & B. Serum fibrinogen level is progressively increase with HbA_1C level.

Table 18: Table showing relationship of serum fibrinogen level with FBS and PPBS

Blood sugar		Group A (n=34)		Group B (n=26)	
		Fibrinogen level (Mean+SD)	P value	Fibrinogen level (mean+SD)	P value
FBS	<100	(2) 591±132	0.39	(4) 462±303	0.73
	100-126	(3) 551.3±20		(3) 394.7±43.09	
	>126	(29) 506±135		(19) 434.6±100.7	
PPBS	<140	0	0.96	(3) 342.7±207	0.20
	140-200	(4) 517.7±197		(4) 486.25±227	
	>200	(30) 514.6±133.7		(19) 437.8±103.4	

Above table show most of type-2 diabetes mellitus patient had poor diabetic control and have high fasting blood sugar (>126) and high PPBS (>200) in both group A & B. No significant association found between serum fibrinogen level and FBS & PPBS.

Table 19: Table showing relationship of serum fibrinogen level with hypoglycemic agent in all diabetic patients (Group A+B)

	n= No. of patients	Fibrinogen level (mean+SD)	P value
No hypoglycemic agent	7	419±72	**0.01**
On OHA	44	449.9±145.7	
On Insulin	9	640.8±126.4	

Above table show maximum number of type-2 diabetes mellitus patient on OHA therapy. Maximum serum fibrinogen level was found in type-2 diabetes patient who taking insulin therapy, significant association found between serum fibrinogen level and insulin therapy (p value <0.05).

Table 20: Table showing various clinical features in different groups

S. No.	Component	Group A (Mean±SD)	Group B (Mean±SD)	Group C (Mean±SD)	P value
No. of patients		**34**	**26**	**28**	
1.	Age (yrs)	53 ± 13	48 ± 15	49 ± 12	0.21
2.	BMI (kg/m^2)	24.82 ± 2.81	22.55 ± 1.66	21.7 ± 1.48	**0.0005**
3.	Duration of diabetes (in yrs)	5.5 ± 3.14	2.8 ±1.8	0	**0.002**
4.	SBP (mmHg)	140 ± 30	122 ± 14	120 ± 16.56	**0.006**
5.	DBP (mmHg)	82 ± 13	73 ± 7	78 ± 9	**0.002**
6.	S. creatinine (mg/dl)	1.36 ± 0.85	0.93 ± 0.3	1.16 ± 0.29	**0.01**
7.	Urine microalbumin (mg/l)	533 ±340	14.4 ± 5.89	18.08 ± 7.14	**0.0001**
8.	Cholesterol (mg/dl)	227.9 ± 57.87	176.8 ± 56.75	166 ± 31.4	**0.001**
9.	TG (mg/dl)	165.6 ± 87.9	124.6 ± 59.1	123.6 ± 30.4	**0.04**
10.	LDL (mg/dl)	112.1 ± 43.7	92.5 ± 35.11	107 ± 24.4	0.06
11.	HDL (mg/dl)	43.3 ± 13.7	40.1 ± 14.3	41.3 ± 9.49	0.38
12.	FBS (mg/dl)	182.6 ± 71.6	165.3 ± 74.6	97 ± 16.51	0.36
13.	PPBS (mg/dl)	298 ± 86.8	264.6 ± 123	152 ± 33.49	0.22
14.	HBA1c (%)	11.71 ± 2.42	10.44 ± 2.41	5.32 ± 0.22	**0.04**
15.	Plasma fibrinogen (mg/dl)	515 ± 138.7	437 ± 137	308.53 ± 52.6	**0.03**

Above table show various clinical feature in different group and their significance

Discussion

In present study total 88 patient were included out of which 34 patient had type-2 diabetes mellitus with microvascular complication and 26 patient had type-2 diabetes mellitus without microvascular complication and 28 was non diabetic. Majority of patient were in 40-60 yrs age group. Mean age for group A, B & C was 53±13, 48±15 and 49±12 respectively which was similar to other study. [1, 2] Present study also had statistically significant age difference in both group. This probable was a reflection of increase complication with increase duration of diabetes.

In present study, among group A out of 34 patients, 20 are male and 14 are female, (M:F ratio 2.9:2) and in group B out of 26 patient, 16 are male and 10 are female (M:F ratio 3.2:2) which is similar to other study.[2]In present study among group A (Type-2 DM with microvascular complication) most common presenting symptom was tingling & numbness (41.17%) followed by polyuria (38.23%) than blurring of vision (29.41%). Among group B most common presenting symptoms was polyuria in (29.92%) cases. In current study most common microvascular complication found was nephropathy 23(67.64%) followed by retinopathy 21(61.76%) and neuropathy 14(41.17%). These findings are similar to previous study.[1]In present study microvascular complication increased with duration of diabetes. Nephropathy was found in 53.8%, 70.55% & 100% patients with duration of diabetes <5yrs, 5-10yrs & >10yrs group respectively. Similarly retinopathy was also increase with duration of diabetes found in 53.8%, 58.8% and 100% patients respectively. Mean duration of diabetes in group A was 5.5±3.14yrs. similar finding was also present in previous studies [3,4] that Duration of diabetes plays important contributory factor in development of microvascular complication. In present study serum fibrinogen level was significantly higher in all diabetic patients compared to non diabetic control .Mean serum fibrinogen level in group A was 515±138.7 and group B was 437±137 which was significantly higher than group C in which mean fibrinogen level was 308.53±52.65, p value <0.003, similar result was also found in previous studies. [2, 5] Present study show that serum fibrinogen level in group A was 515±138.7 and in group B mean fibrinogen level was 437±137, p value 0.02. Serum fibrinogen level was significantly higher in type-2 DM patients with microvascular complication group compared to type-2 DM patient without microvascular complication group. Similar finding also found in many studies. [4, 6, 7] Age is considered to be important contributing factor in development of complication but present study did not show any correlation between serum fibrinogen and age which indicate that both are independent to each other.In present study serum fibrinogen level was more in female patients compared to male patients among group A (513±179, 501.3±145.3, p value 0.83) but level of difference is not significant. Similarly among group B & C no significant association was found between fibrinogen level and sex. other studies [3, 5] also correlate with this comment. Present study show no significant correlation between serum fibrinogen level and duration of diabetes. Present study show that mean fibrinogen level increase with BMI. Mean fibrinogen level in group A (433±139, 564±129, p value 0.01) in normal (18.5-22.99) and over weight (23-27.49) patient respectively. Similarly in group B and C fibrinogen

level is (416.9±126.7, 492.2±166.7, p value 0.002) and (299±54.65, 343±24.74, p value 0.04) respectively. Significant association was found between fibrinogen level and BMI as in other studies [5,8,9]Present study show significant association between serum fibrinogen level and urine albumin excretion rate (p value 0.04).Mean fibrinogen level in different albuminuria group (<30mg/l, 30-300mg/l, >300mg/l) was (439.7±135.15, 525.7±145.4, 545.7±112.2, p value 0.04). Similar result was also found in previous studies. [6, 10] In current study mean fibrinogen level was (381.7±118.1, 541.1±121.7, p value 0.005) in type-2 diabetes mellitus patients with total cholesterol (<200, >200) group. Significant association was found with total cholesterol (p value 0.005) but did not show any significant association with TG, HDL and LDL, same as other studies.[5,11] In present study maximum serum fibrinogen level was seen in patients with HbA_1C >12% among both group A & B was 567.5±173.4 and 538.6±184.6 respectively. Serum fibrinogen level progressively increased with HbA_1C level and positive correlation was seen between fibrinogen level and HbA_1C (p value <.0.05). as it was presents in past studies.[12,13]Present study did not show any significant linear relationship between serum fibrinogen level and FBS and PPBS. Current study show significant association between serum fibrinogen level and insulin therapy (p value 0.01). mean fibrinogen level was (640.8±126.4, 449.9±145.7, 419±72, p value 0.01) in type-2 DM on insulin, OHA and patients who not taking any hypoglycemic agent. Insulin cause intensive glycemic control lead to potential beneficial effects (reduce HbA_1C, TG and Cholesterol level) but a possible adverse effect is increase fibrinogen level. Similar result were also found in other studies [14, 15].

Conclusion

On the basis of observations of present study its concluded that Serum fibrinogen level was found to be higher in Type-2 diabetic patients as compared to non diabetic controls and further increase in patients who having microvascular complication .Serum fibrinogen level was directly correlated with poor glycemic control (HbA1c).Serum fibrinogen level did not directly correlated with duration of diabetes Indicating both are independent risk factor. Serum fibrinogen level was directly correlated with Total cholesterol but did not correlated with TG and LDL. Serum fibrinogen level was correlated with BMI and urine albumin excretion rate but did not correlated with Age, Sex, FBS and PPBS. Serum fibrinogen level was elevated in all Type-2 diabetic patients taking OHA and Insulin therapy but more elevated fibrinogen level was found in patients taking insulin therapy. Furthermore intervention studies are needed to establish whether the reduction of elevated fibrinogen level either in form of medications or life style modification must be included in the targets for decreasing the number of microvascular complications in type-2 DM.

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