Correlative study of lipid profile, fibrinogen level and BMI in Type 2 diabetes mellitus with hypertension

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Abstract

Diabetic hypertensives have higher cardiovascular morbidity and mortality than general population. Various risk factors like age, BMI, hypertension, smoking, dyslipidemia, etc. have been extensively studied, but still these together cannot explain increased cardiovascular morbidity and mortality in diabetes. Several studies have shown that fibrinogen is a powerful independent risk factor for cardiovascular disease. In the present study, fibrinogen levels in 50 diabetic hypertensives were estimated and its relation to BMI and lipid profile parameters was studied. The objectives of this study are: 1) To estimate plasma fibrinogen levels in patients with type 2 diabetes mellitus and hypertension. 2) To correlate plasma fibrinogen with BMI and lipid profile parameters. Higher plasma fibrinogen levels were found in diabetic hypertensives. There was a significantly positive correlation between plasma fibrinogen and BMI. There was a significantly positive correlation between BMI and total cholesterol levels. Diabetic hypertensives have higher fibrinogens levels, which was related to BMI and total cholesterol level in a statistically significant manner.
Keywords: Body Mass Index; Total Cholesterol.

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INTRODUCTION

Diabetes mellitus is a group of metabolic diseases characterised by hyperglycemia resulting from defects in insulin secretion, insulin action or both. The chronic hyperglycemia of diabetes is associated with long-term damage/dysfunction and failure of various organs, especially the eyes, kidneys, nerves, heart and blood vessels. Type 2 Diabetes Mellitus forms 95% of all diabetes. The greatest increase will be in India i.e. from 19.4 million (1995) to 57.2 million by 2025.

MATERIALS AND METHODS
Source of data
a. The patients with diagnosis of type 2 diabetes mellitus with hypertension (both outpatient and inpatient) coming to K.R. Hospital, Mysore during the period of March 2013 to August 2013.
b. Controls were subject who do not have type 2 diabetes mellitus and hypertension.

Method of collection of data
- Patients were selected randomly
- Sample size – 70
- Cases – 50
- Controls – 20
- Study period from March 2013 to August 2013

Inclusion Criteria
All patients with diagnosis of type 2 diabetes mellitus with hypertension (both old and new cases). (Diagnosis of diabetes mellitus as per the ADA 2005 criteria) (Diagnosis of systemic hypertension according to Joint National Committee 7th report).

Exclusion Criteria
- Patients with abnormal lipid profile secondary to hypothyroidism, alcoholic liver disease, renal failure and nephrotic syndrome.
- Patients on drugs like glucocorticoids estrogens and progesterons.
- Patients with history of familial dyslipidemia.
- Pregnant women.

OBSERVATIONS AND RESULTS

Table 1: Showing age and sex distribution

Age (in years)	Cases			Controls		
	Male	Female	Total	Male	Female	Total
40-45	0 (0%)	2 (4%)	2 (4%)	3 (15%)	3 (15%)	6 (30%)
46-50	2 (4%)	12 (24%)	14 (28%)	3 (15%)	0 (0%)	3 (15%)
51-55	2 (4%)	8 (16%)	10 (20%)	6 (30%)	0 (0%)	6 (30%)
56-60	7 (14%)	2 (4%)	9 (18%)	0 (0%)	5 (25%)	5 (25%)
61-65	4 (8%)	6 (12%)	10 (20%)	0 (0%)	0 (0%)	0 (0%)
≥ 66	3 (6%)	2 (4%)	5 (10%)	0 (0%)	0 (0%)	0 (0%)
Total	18 (36%)	32 (64%)	50 (100%)	12 (60%)	8 (40%)	20 (100%)

64% of cases were females as against 36% of males. 60% of controls were females as against 40% of males. The youngest case that was observed in the present study was 42 years old and oldest case observed in the present study was 70 years old. The mean age of the study group was 55.80 ± 741 years and control group was 51.6 ± 6.57 years.

Table 2: Showing body mass index (weight/height^2)

BMI	Cases			Controls		
	Male	Female	Total	Male	Female	Total
< 18.5	0 (0%)	2 (4%)	2 (4%)	0 (0%)	2 (10%)	2 (10%)
18.5-24.9	11 (22%)	13 (26%)	24 (48%)	10 (50%)	3 (15%)	13 (65%)
25-29.9	4 (8%)	8 (16%)	12 (24%)	2 (40%)	3 (15%)	5 (25%)
≥ 30	3 (6%)	9 (18%)	12 (24%)	0 (0%)	0 (0%)	0 (0%)
Total	18 (36%)	32 (64%)	50 (100%)	12 (60%)	8 (40%)	20 (100%)
Mean±SD	25.80± 4.14	26.36± 5.99	26.16± 5.36	23.54± 1.86	21.03± 2.77	22.79± 2.40

The minimum and maximum BMI in female cases that was observed in present study was 15.98 kg/m^2 and 35.56 kg/m^2 with a mean BMI of 26.36 kg/m^2. The minimum and maximum BMI in male cases that was observed in present study was 23.3 kg/m^2 and 33.7 kg/m^2 with a mean BMI of 25.8 kg/m^2. The mean BMI of cases and controls were 26.16±5.36 kg/m^2 and 22.79±2.4 kg/m^2. 24% of the cases in the present study were observed to be in overweight category. 24% of the cases in the present study were observed to be in obese category. 25% of controls in present study were observed to be in overweight category. None of the controls were observed to be obese.

Table 3: Showing triglycerides

Trigly-cerides	Cases			Controls		
	Male	Female	Total	Male	Female	Total
< 150	0 (0%)	0 (0%)	0 (0%)	6 (30%)	7 (35%)	13 (65%)
150-199	2 (4%)	4 (8%)	6 (12%)	6 (30%)	1 (5%)	7 (35%)
200-499	16 (32%)	28 (56%)	44 (88%)	0 (0%)	0 (0%)	0 (0%)
≥ 500	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	18 (36%)	32 (64%)	50 (100%)	12 (60%)	8 (40%)	20 (100%)
Mean±SD	261.76± 46.20	233.41± 43.03	243.62± 45.83	153.22± 15.30	107.1625± 44.01	168.58± 25.37

All cases had serum triglyceride values more than 150 mg/dl and 88% of them had serum triglyceride values more than 200 mg/dl. All controls had serum triglyceride values less than 200 mg/dl and 65% of them had a serum triglyceride values less than 150 mg/dl. The mean serum triglyceride values of cases and controls were 243.62 ± 45.83 mg/dl and 168.58 ± 25.37 mg/dl.

Table 4: Showing total cholesterol / HDL-cholesterol ratio

TC/ HDL-C	Cases			Controls		
	Male	Female	Total	Male	Female	Total
< 4	2 (4%)	1 (2%)	3 (6%)	6 (30%)	6 (30%)	12 (60%)
4-4.9	4 (8%)	12 (24%)	16 (32%)	5 (25%)	2 (10%)	7 (35%)
5-5.9	8 (16%)	15 (30%)	23 (46%)	1 (5%)	0 (0%)	1 (5%)
6-6.9	4 (8%)	3 (6%)	7 (14%)	0 (0%)	0 (0%)	0 (0%)
> 7	0 (0%)	1 (2%)	1 (2%)	0 (0%)	0 (0%)	0 (0%)
Total	18 (36%)	32 (64%)	50 (100%)	12 (60%)	8 (40%)	20 (100%)
Mean±SD	5.1057± 0.7368	5.2098± 0.8838	5.17± 0.82	4.098± 0.7961	3.6308± 0.6405	3.92± 0.64

62% of cases had TC/HDL ratio greater than 5. 95% of controls had TC/HDL ratio below 5.

Table 5: Showing plasma fibrinogen

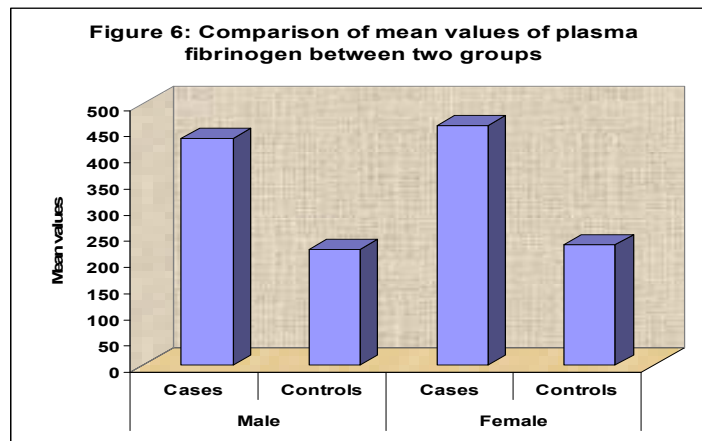| Plasma fibrinogen	Cases			Controls		
	Male	**Female**	**Total**	**Male**	**Female**	**Total**
< 150	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
150-300	1 (2%)	7 (14%)	8 (16%)	11 (55%)	7 (35%)	18 (90%)
300-450	9 (18%)	7 (14%)	16 (32%)	1 (5%)	1 (5%)	2 (10%)
> 450	8 (16%)	18 (36%)	26 (52%)	0 (0%)	0 (0%)	0 (0%)
Total	**18 (36%)**	**32 (64%)**	**50 (100%)**	**12 (60%)**	**8 (40%)**	**20 (100%)**
Mean±SD	**433.80± 99.62**	**457.65± 146.90**	**449.06± 131.26**	**221.16± 72.33**	**229.90± 76.53**	**150.80± 15.28**

The minimum plasma fibrinogen in the present study was 188 mg/dl. The maximum plasma fibrinogen in the present study was 688 mg/dl. The mean plasma fibrinogen levels in cases and controls were 449.06 ± 131.26 mg/dl and 150.80 ± 15.28 mg/dl. 52% of cases had plasma fibrinogen levels greater than 450 mg/dl. All controls had normal plasma fibrinogen.

Table 6: Showing comparison of mean values of various anthropometric parameters of obesity between two groups

		Cases	Controls	p-value	Inference
Height (in cms)	M	160.67	169.14	0.001	S
	F	148.69	169.33	0.001	S
Weight (in kgs)	M	67.11	67.35	0.907	NS
	F	58.62	60.33	0.771	NS
BMI (Body Mass Index)	M	25.80	23.54	0.049	S
	F	26.36	21.03	0.041	S
WC (Waist Circumference) (in cms)	M	101.33	95.00	0.001	S
	F	99.81	77.00	0.001	S
HC (Hip circumference) (in cms)	M	98.00	96.57	0.049	S
	F	103.00	90.50	0.017	S
W/H ratio (Waist/Hip ratio)	M	1.035	0.93	0.001	S
	F	0.97	0.90	0.032	S

p < 0.05, statistically significant

Male diabetic hypertensives had higher waist circumference, hip circumference, waist-hip ratio and BMI, compared to the males in control group. The difference was statistically significant. Similar results were also seen between female diabetic hypertensives and female controls. Though it appears from the table that controls had higher height and weight values than the cases, the BMI calculation shows that the cases were overweight or obese compared to the controls. The lower weight in the cases may be due to diabetes. Elevated triglycerides, VLDL-cholesterol, TCH-HDL ratio and low levels of HDL-cholesterol were observed among male and female diabetic hypertensives compared to male and female controls. The difference was statistically significant. However, there were no statistically significant differences between total cholesterol and LDL cholesterol between the two groups.

Figure 6: Comparison of mean values of plasma fibrinogen between two groups

Elevated plasma fibrinogen levels was observed among male and female diabetic hypertensives compared to male and female controls. The difference was statistically significant.

Table 7: Showing correlation coefficient between P. fibrinogen and lipid profile

	P. fibrinogen	p-value
TCh	0.348	0.013
HDL-C	- 0.156	0.279
TC/HDL C	0.208	0.148
TG	0.276	0.05
LDL-C	0.127	0.381

$p < 0.05$, statistically significant

Plasma fibrinogen was positively correlated to total cholesterol, TC/HDL-C, triglycerides and LDL-C, negatively correlated to HDL-C levels. Significant correlation was found between plasma fibrinogen and total cholesterol. Plasma fibrinogen is positively correlated to BMI which is statistically significant.

DISCUSSION

The mean age of male and female diabetic hypertensives is significantly higher than that of controls. Similar results were observed by Han *et al*. and Sosenko *et al*. It suggests that as mean age in population advances, the number of people with diabetes and hypertension also increases. 2. Anthropometric parameters of obesity. The mean height in male and female diabetic hypertensives was lesser than those in control group. This difference was statistically significant. Similar results were observed by Han *et al*. The mean weight values were not different in two groups, suggesting it is a poor marker of body fat. Similar results were observed by Han *et al*. The mean BMI of male diabetic hypertensives is 25.80 and female diabetic hypertensives is 26.36, suggesting that they are overweight. Similar results were observed by Han *et al*. The mean waist circumference was significantly higher in male and female diabetic hypertensives than controls. It suggests presence of abdominal obesity in diabetic hypertensives. Similar results were observed by Han *et al*. Waist circumference may be taken as bedside marker for abdominal obesity. It is a sensitive indicator for central obesity. The mean values of hip circumference were higher in male and female diabetic hypertensives than controls. Similar results were observed by Han *et al*. The mean values of waist-hip ratio is significantly higher in male and female diabetic hypertensives than controls. Similar results were observed by Han *et al*. and Sosenko *et al*. It suggests that diabetic hypertensives have central obesity more commonly than controls. Waist-hip ratio is a sensitive indicator of central obesity. The mean values of total cholesterol among male and female diabetic, hypertensives and controls did not vary significantly, suggesting that diabetic dyslipidemias do not alter total cholesterol levels significantly. Similar results were observed by Sosenko *et al*. The mean values of HDL-C among male and female diabetic hypertensives were significantly lower than that of controls. Similar results were observed by Sosenko *et al*. and Subhankar Chowdury *et al*. Low HDL level in diabetics increases the risk of coronary artery disease. The mean values of LDL-C were not different in diabetic hypertensives and controls, which is one of the features of diabetic dyslipidemia. However there will be increase in small dense LDL particles which makes it more atherogenic. Similar results were observed by Sosenko *et al*. The mean values of VLDL-C were significantly higher in diabetic hypertensives than controls. This is because of increased triglyceride production and VLDL is calculated by triglycerides/5. The mean values of triglycerides were significantly higher in male and female diabetic hypertensives than controls. Similar results were observed by Sosenko *et al*. Hyper-triglyceredemia is one of the feature of diabetic dyslipidemia. Hyper-triglyceredemia in diabetics is due to increase in the production of triacylglycerol and fatty acids in liver. The mean values of TCH/HDL-C ratio were significantly higher in diabetic hypertensives than controls. Higher ratio of TCH/HDL increases the risk for coronary artery disease. Mean plasma fibrinogen in diabetic hypertensives was significantly raised compared to controls. Similar results were observed by Barbara Glowinska *et al*. and Anjula Jain *et al*. There was a positive correlation between Body Mass Index and Total Cholesterol which was statistically significant. Similar results were observed by Subhankar Chowdury *et al*. and Hideki *et al*. Positive correlation was found between plasma fibrinogen levels and total cholesterol, which was statistically significant. Similar results were observed by Anjula Jain *et al*. and Barbara Glowinska *et al*. Significant positive correlation was found between plasma fibrinogen and BMI. Similar results were observed by Anjula Jain *et al*. and Barbara Glowinska *et al*.

CONCLUSIONS

Anthropometric parameters of obesity were significantly higher in diabetic hypertensives than controls. Diabetic hypertensive patients have central obesity pattern. The pattern of dyslipidemia seen in diabetic hypertensives are elevated triglycerides, VLDL-C, TC/HDL and decreased HDL-C. Diabetic hypertensives have higher plasma fibrinogen levels and it is significantly related to BMI and lipid profile parameters.

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