# Comparative Study of Blood Sugars, Lipid Profile, in Type 2 Diabetes Mellitus and its Correlation to Ischemic Heart Disease

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## Abstract

*Introduction:* India has nearly 33 million diabetic subjects. Indians have a genetic phenotype characterized by low BMI, high upper body adiposity, high body fat percent, and high levels of insulin resistance. In CUPS (Chennai Urban Population study), the prevalence of CAD was high among diabetics (21.4%, compared to 14.9% among patients with IGT and 9.1% among patients with normal glucose tolerance). *Methodology:* A total of 80 patients were included in the study based on the inclusion criteria as mention above. The data was collected in a predesigned proforma by questionnaire method, physical examination and lab investigation. *Results:* There were 16 patients [40%] with their blood sugars in between 201 to 300mg/dl as compared to 6 patients [15%] in the control group. Another 7 patients [17.5%] had blood sugars more than 300mg/dl as compared to 2 patients [5%] in the control group. *Conclusion:* Dyslipidemia also was more common in the IHD group, suggesting that a aggressive treatment of dyslipidemia initially may be beneficial in the long run.

**Keywords:** Blood Sugars; Lipid Profile; Type 2 Diabetes Mellitus.

## Introduction

Cardiovascular Disease and Diabetes mellitus rank the first and eighth places respectively in the list of killer diseases worldwide [1]. The worldwide prevalence of Diabetes mellitus has risen dramatically over the past two decades. From world epidemiologic data incidence has increased from 8.9% to 12.3% [2]. Globally, more than 100 million people have diabetes and this figure is projected to double in next 20 years [3]. The United Kingdom prospective diabetes study 23(UKPDS) [4] clearly pointed out the fallowing factors to be associated with increased cardiovascular risk. These are increased density of low-density lipoprotein (LDL) cholesterol, decreased concentration of high-density lipoprotein (HDL) cholesterol, raised blood pressure and hyperglycemia along with smoking.

The important messages of this study were

1. Coronary artery disease is the major cause of mortality in type 2 DM.

2. Patients without the evidence of disease related to atheroma at the time of diagnosis of type 2 DM had an increased standardized mortality ratio compared to that of non-diabetic population.

3. Potentially modifiable risk factors for the coronary artery disease were

   a. Lipoprotein abnormalities

   b. Hypertension

   c. Hyperglycemia and

   d. Smoking [4]

Hypertension was found to be an important cardiovascular risk factor in the HOPE (Hypertension outcome prevention Evaluation) study. Decreasing the level of B.P even if were to be in the normal range was found to be associated with decreased mortality [5].

India has nearly 33 million diabetic subjects. Indians have a genetic phenotype characterized by low BMI, high upper body adiposity, high body fat percent, and high levels of insulin resistance [6]. In CUPS (Chennai Urban Population study), the prevalence of CAD was high among diabetics (21.4%, compared to 14.9% among patients with IGT and 9.1%

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among patients with normal glucose tolerance) [7]. Overt diabetes is well established as primary and secondary risk factor for CAD [8]. Cardiovascular mortality is twice as high in men and four times high in women with diabetes compared to non diabetic population (Framingham heart study) [9,10].

Diabetic men have sudden death 50% more often and diabetic women 300% more often than do age matched non-diabetics [11]. Cumulative mortality due to coronary artery Disease (CAD) in Non-Insulin Dependent Diabetes Mellitus (NIDDM) is 35% by 55 year of age, higher compared to non-diabetics in whom it is 4-8%. WHO multinational study of vascular disease in diabetics (WHO-MSVDD) demonstrated CVD as the largest cause of mortality amongst diabetics (50%) [11].

**Methodology**

A detail study of the medical history, clinical examination, BMI, Waist-Hip ratio, HbA1c, FBS, PPBS and lipid profile were done for all the patients. A total of 80 patients were included in the study

*Inclusion Criteria*

1. All the patients with type 2 DM were included in the study irrespective of their on going treatment

2. Patients with diabetes who presented with a acute coronary syndrome like presentation were included in the IHD group. The following crieteron were used to label the diabetic patients to have acute coronary syndrome.

*Exclusion Criteria*

1. Patients with previous history of myocardial infraction.

2. Patients presenting with a LBBB pattern on the electrocardiogram.

3. Patients with a previous history of stoke or patients suffering with end stage renal disease

4. Patients with other complication of diabetes such

as ketosis, gangrene etc

*Method of Collection of Data*

A total of 80 patients were included in the study based on the inclusion criteria as mention above. The data was collected in a predesigned proforma by questionnaire method, physical examination and lab investigation. The data included:

• Duration of diabetes mellitus

• Duration of hypertension and the blood pressure on presentation

• BMI and Wasit Hip ratio

• HbA1c, FBS and PPBS

• Fasting Lipid profile

All the patients underwent similar laboratory investigations, a 12 lead electrocardiogram was done for the patients in the study. All the 80 patients were then divided into two groups .

The control group, in which included patients with type 2 diabetes mellitus diagnosed according to the criteria approved by the American Diabetic Association:

• Symptoms of diabetes plus casual plasma glucose concentration 200mg/dl (11.1mmol/L). Casual is defined as any time of day without regard to time since last meal.

• FPG > 126 mg/dl (7.0 mmol/L). Fasting is defined as no caloric intake for atleast 8 hours.

• 2 hour post load glucose $\geq$200 mg/dl (11.1 mmol/ L) during an OGTT

The test should be performed as described by WHO using glucose load containing the equivalent of 75g anhydrous glucose dissolved in water.

**Results**

This study included 80 patients, all of whom were diabetics. They were categorized into two groups.

• Control group – In which patient had diabetes without ischemic heart disease.

• Study group – In which patient had diabetes with

**Table 1:** Sex distribution

**SEX * Group Crosstabulation**

| | | | Group | | Total |
|---|---|---|---|---|---|
| | | | DM w IHD | DM wt IHD | |
| Sex | Male | Count | 28 | 30 | 58 |
| | | % within Group | 70.0% | 75.0% | 72.5% |
| | Female | count | 12 | 10 | 22 |
| | | % within Group | 30.0% | 25.0% | 27.5% |
| | Total | Count | 40 | 40 | 80 |
| | | % within Group | 100.0% | 100.0% | 100.0% |

ischemic heart disease.

Out of 40 patients in the IHD group, 28 patients [70%] were males and 12 patients [30%] were females, this was very similar to the non IHD group.

In the study 20 patients [50%] in study group had a duration of diabetes more than 10 years as compared to only 5 patients [12%] in control group. The mean duration of the diabetes in the study group was 10.35 years as compared to 7 years in the control group. The mean duration of diabetes in the study group was 10.3± 6.3 as compared to a mean of 7.1 ± 4.4 in the diabetic without IHD.

**Table 2:** Duration of diabetes and its association

| DURCD * GROUP Crosstabulation | | | | | |
|---|---|---|---|---|---|
| DURCD * GROUP Crosstabulation | | | Group | | Total |
| | | | DM w IHD | DM wt IHD | |
| DURCD | Below 5 | Count | 8 | 11 | 19 |
| | | % within Group | 20.0% | 27.5% | 23.8% |
| | 5-10 | Count | 12 | 24 | 36 |
| | | % within Group | 30.0% | 60.0% | 45.0% |
| | 10+ | Count | 20 | 5 | 25 |
| | | % within Group | 50.0% | 12.5% | 31.3% |
| Total | | count | 40 | 40 | 80 |
| | | % within Group | 100.0% | 100.0% | 100.0% |

*Contingency Coefficient = 0.380; P < 0.001 Significant Association*

In this study it was seen that only 11 patients [27.5%] had a good control of HbA1c in the study group as compared to 35 patients [87.5%] in the control group. It was also noticed that 20 patients [50%] had poor glycemic control over 3 months as compared to 3 patients [7.5%] in the control group. The mean HbA1c in the study group was 8.67± 2.24 as compared to a mean of 6.34 ± 1.33.

**Table 3:** Glycosylated hemoglobin [HbA1c] and its Association

| HBCD * GROUP Crosstabulation | | | | | |
|---|---|---|---|---|---|
| | | | Group | | Total |
| | | | DM w IHD | DM wt IHD | |
| HBCD | good control | Count | 11 | 35 | 46 |
| | | % within Group | 27.5% | 87.5% | 57.5% |
| | average | Count | 9 | 2 | 11 |
| | | % within Group | 22.5% | 5.0% | 13.8% |
| | poor | Count | 20 | 3 | 23 |
| | | % within Group | 50.0% | 7.5% | 28.8% |
| Total | | Count | 40 | 40 | 80 |
| | | % within GRUOP | 100.0% | 100.0% | 100.0% |

*Contingency Coefficient = 0.519; P < 0.001 Significant*

There were 16 patients [40%] with their blood sugars in between 201 to 300mg/dl as compared to 6 patients [15%] in the control group. Another 7 patients [17.5%] had blood sugars more than 300mg/dl as compared

**Table 4:** Fasting blood sugars and its ssociation

| FBSCD * GROUP Crosstabulation | | | | | |
|---|---|---|---|---|---|
| | | | Group | | Total |
| | | | DM w IHD | DM wt IHD | |
| FBSCD | Bel 126 | Count | 5 | 14 | 19 |
| | | % within Group | 12.5% | 35.0% | 23.8% |
| | 127-200 | Count | 12 | 18 | 30 |
| | | % within Group | 30.0% | 45.0% | 37.5% |
| | 201-300 | Count | 16 | 6 | 22 |
| | | % within Group | 40.0% | 15.0% | 27.5% |
| | 301 + | Count | 7 | 2 | 9 |
| | | % within Group | 17.5% | 5.0% | 11.3% |
| Total | | Count | 40 | 40 | 80 |
| | | % within Group | 100.0% | 100.0% | 100.0% |

to 2 patients [5%] in the control group.

*Contingency Coefficient = 0.371; P < 0.005 Significant*

In comparing lipid profiles it was noticed that 19 patients [47.5%] in the study group had increased triglycerides ,an increased LDL and decreased HDL

**Table 5:** Lipids and its association

| Crosstab | | | Group | | Total |
|---|---|---|---|---|---|
| | | | DM w IHD | DM wt IHD | |
| Try w gdl | High | Count | 19 | 8 | 27 |
| w ldl | | % within GROUP | 47.5% | 20.0% | 33.8% |
| | Low | Count | 21 | 32 | 53 |
| | | % within Group | 52.5% | 80.0% | 66.3% |
| Total | | Count | 40 | 40 | 80 |
| | | Within GROUP | 100.0% | 100.0% | 100.0% |

as compared to 8 patients [20%] in the control group.

*Contingency Coefficient = 0.279; P < 0.009 Significant*

## Discussion

As we all know that Type 2 DM has reached an epidemic proportions, and an increasing proportion of patients with coronary heart disease. Type 2 DM increases the risk of CAD by a factor of two to four. Cardiovascular Disease and Diabetes mellitus rank the first and eighth places respectively in the list of killer diseases worldwide, and the combination of the two, will prove much more lethal. Overt diabetes is well established as primary and secondary risk fact for CAD.

Coronary heart disease in diabetics has specific characteristics, in particular, more extensive arteriosclerosis. Diabetic patients are also more frequently asymptomatic, with silent ischemia and other dreadful complications. The issue of the association between diabetes and CAD is likely to become more important for two reasons

- The incidence of type 2 DM is increasing among both high as well as the low risk population.

- Secondly, there has not been a significant decline in the death rate due to CAD in the diabetic population as seen over the last three decades

Thus it is necessary to find out the risk factors which will make a diabetic patient more prone for coronary heart disease. As previously stated, the most important risk factors for CAD in a diabetic are age, sex, hypertension, an elevated serum lipid levels, smoking, and last but not the least obesity. There have been number of studies which have correlated these risk factors individually and the occurrence of CAD in a diabetic patient, but there are very few studies in which all the risk factors were compared in a single study. The present study was undertaken as a extension of the similar studies carried out throughout the world.

In the study, the following criteria were compared;

- Duration of diabetes

- Hypertension

- BMI and Waist Hip ratio

- Fasting blood sugars and

- Lipid profile

The present study consisted of 80 patients. All of whom were diabetics, diagnosed by the ADA criteria. They were then divided into two groups, according to the presence or absence or coronary heart disease. The control group had all diabetics without ischemic heart diseases (DM wt IHD) and the study group consisted of diabetic with ischemic heart diseases (DM w IHD).

There were 28(70%) males and 12(30%) females in the study group, suggesting that the incidence of IHD was greater in the male population(2.3:1) (P value < 0.024).

In the study it was seen that distribution of CAD was common in the fourth to the sixth decade of life, this was similar to the other studies done previously (P value < 0.051).

There were 20 (50%) patients in the IHD group with duration of diabetes for more than 10years,as compared to 5(12%) patients in the non IHD group. This showed that longer the duration of DM the greater is the chance for developing CAD. This finding was similar to the other studies like the UKPDS trial, and the Kumamoto study(P value < 0.001).

It was seen that 32(80%) patients had a previous history of hypertension in the IHD group as compared to15 (37.5%) patients in the non IHD group. This was in concordance with the HOPE (Hypertension outcome prevention Evaluation) study(P value < 0.001).

There were 22(55%) patients who had a hypertensive blood pressure response at the time of admission as compared to 12(30%) in the non IHD group. Thus hypertension was a independent risk factor for CAD (P value < 0.024).

It was seen that the patients in the IHD group had a higher Hip Waist ratio with a mean of 0.98 in males and 0.95 in females as compared to 0.88 in males and 0.84 in females in the non IHD group. A total of 23

(57.5%) patients had a higher WHR in the IHD group. There were similar findings in the BMI also, with 19(47.5%) patients been overweight and 6(15%) patients were obese, as compared to 10(25%) patients and only one patient respectively in the non IHD group. Thus obesity was a significant risk factor or developing IHD in diabetic population (P value < 0.001).

It was seen that 23(57.5%) patients had a fasting blood sugars levels more than 200mg% in the IHD group as compared to 8(20%) patients in the non IHD population. This was similar to the study done by K. Cooper et al. (The Heart, 2003 May) in which it was seen that a single raised fasting blood sugars levels predicts a adverse outcome (P value < 0.005).

It was seen that 11(27%) patients had a good glycemic control, 9(22%) had a fair glycemic control and as high as 20(50%) patients had a poor glycemic control (HbA1c>8%) in the IHD group as compared to 35 (87%), 2(5%) and 3(7%) patients respectively in the non IHD group. Thus it was concluded that 29(72%) patients had a poor control of their diabetes. The mean HbA1c in the study group was 8.67± 2.24 as compared to a mean of 6.34 ± 1.33.

There was a significant derangement of the lipid profile in the IHD group with 19(47.5%) patients having a high triglyceride level along with a low HDL and a high LDL as compared to 8(20%)patients in the non IHD group . Thus lipid lowering strategies must be a main aim in diabetic patients(P value < 0.009).

The role of HbA1c and dyslipidemiain the diabetic population and its association with IHD was undoubtedly proved by many studies. These findings were similar in the present study also.

### Conclusion

There was a higher prevalence of IHD in the patients with a poor control of diabetes(shown by a HbA1c of more than 8%). It was also seen that the patients with IHD had a higher valve of fasting blood sugar level on presentation.

### References

1.  Park k. Coronary Heart Disease, In: Park's Textbook of Preventive and Social Medicine, 18[th]ed, 2005, M/s BanarasidasBhanot, Jabalpur, p. 290-295.

2.  Diabetes Mellitus. Harrisons Principles of Internal Medicine 16[th]ed pp 2152-2180.

3.  McGuire DK Granger C.B, Durham NC. Diabetes and ischemic Heart Disease. Am Heart Journal 1999; 138:S366-S375.

4.  R.C. Turner, H.A.W. Neil, Millins H et al. Risk factors for coronary artery disease in NIDDM: United Kingdom Prospective Diabetes Study(UKPDS:23) BMJ 1998; 316:823-8.

5.  Effects of Angiotensin Converting Enzyme, ramipril on cardiovascular events in high risk patients, Heart Outcome Prevention Evaluation (HOPE) study N Engl J Med 2000:145-153.

6.  Ramachandran A. Epidemiology of diabetes in India-three decades of research JAPI 2005; 53:34-38.

7.  Mohan.V: why are Indian diabetic subjects more prone to coronary artery disease.Int J Diabin Developing Countries 2004; 24:1-6.

8.  Muhlestein JB, Anderson JL, Horne et al :Effects of fasting glucose levels on mortality rate in patients with and without diabetes mellitus and coronary artery disease under growing percutaneous coronary intervention. Intermountain Heart Collaborative Study (IHCS) group Am Heart J 2003; 146:351-8.

9.  Kannel WB, Mc Gee DL: Diabetes and Cardiovascular risk factors: the Framingham study, Circulation 1979; 59:8-13.

10. Almdal T, scharling H, Jensen JS: the independent effect of type 2 diabetes mellitus on ischemic heart disease, stroke, and death: A population- based study of 13,000 men and women with 20 years of follow-up. Arch Intern med 2004; 164:1422-1426.

11. Mukherjee S: Diabetes and Coronary Heart Disease. In:Ahuja MMS, Tripathy BB, Moses SGP et al(eds): RSSDI Text Book of Diabetes Mellitus, 1st ED, 2202,PP. 541-548.