

**A STUDY OF CORRELATION BETWEEN HIGH NORMAL HBA1C AS RISK FACTOR FOR CORONARY HEART DISEASE WITH FRAMINGHAM RISK SCORE IN NON-DIABETIC PATIENTS**

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**ABSTRACT**

**Introduction:** CHD is a state which occurs when there is an imbalance between the supply and demand of oxygen in the myocardium, resulting in a portion of the myocardium receiving inadequate blood and oxygen. The most typical cause is plaque buildup, which results in the coronary artery narrowing and inadequate oxygen delivery to the heart muscles.

**Aims:** Study Relation between High Normal HbA1c Level and Coronary Heart Disease and Calculation of Framingham Risk Score for Developing Coronary Heart Disease and Its Correlation with HbA1c.

**Materials and Methods:** The present study was a it is a cross-sectional study. This Study was conducted from One and half year study from January 2021 to June 2022 at Department of University Shri B M Patil Medical College Hospital and Research Centre, Bijapur.

**Result:** In <5.5, 20 (54.1%) patients had HDL Category <40 and in ≥5.5, 44 (75.9%) patients had HDL Category <40.

**Conclusion:** We found that, male population was higher than the female population and male: female ratio was 1.15:1 but this was not statistically significant. It was found that, most of the patients had K/C/O HTN in ≥5.5 group compared to <5.5 group but this was not statistically significant and we also found that, most of the patients had SBP 140-159 in ≥5.5 group compared to <5.5 group it was not statistically significant.

**Keywords:** Diabetes, HbA1c, Hypertension and Coronary heart disease.

## **INTRODUCTION**

CHD is a state w h i c h occurs when there is an imbalance between the supply and demand of oxygen in the myocardium, resulting in a portion of the myocardium receiving inadequate blood and oxygen. The most typical cause is plaque buildup, which results in the coronary artery narrowing and inadequate oxygen delivery to the heart muscles.

In a healthy state, the heart's muscle regulate the flow of blood rich in oxygen at any given amount of oxygen demand in order to avoid myocytes from receiving insufficient oxygen, which could lead to ischemia and infarction.

### **Framingham Risk Score**

The 10-year cardiovascular risk of an individual is calculated using the Framingham Risk Score, a gender-specific classification. The 10-year risk of getting coronary heart disease was initially estimated using the Framingham Risk Score using information from the Framingham Heart Study. In order to quantify the 10-year risk of cardiovascular disease, cerebrovascular events, peripheral artery disease, and heart failure were subsequently added as illness outcomes for the 2008 Framingham Risk Score.

The Framingham Risk Score can be used to determine a person's 10-year percent risk of developing coronary heart disease (CHD).

- Those with LOW RISK have a 10-year CHD risk of 10% or less.
- CHD risk ranges from 10 to 20% for those with INTERMEDIATE RISK.
- People at HIGH RISK have a 20% or higher CHD risk.

### **HbA1c and CHD**

The use of glycosylated haemoglobin (HbA1c), a measure of average blood sugar readings during a 12-week period, in clinical practise has likewise been suggested since it has advantages over fasting blood glucose, such as reduced intra-individual variability. Epidemiological studies also demonstrated that HbA1c was more accurately predictive of CHD outcome than fasting blood glucose, with a stronger association between HbA1c and the dangers of CHD and overall mortality.

The goal of their current investigation is to determine whether the seriousness of coronary heart disease (CHD) in people without diabetes diagnoses will be correlated with the HbA1c level. If any, we think the clinical implications of our study will add important knowledge to the discussion of whether the HbA1c level may be used to predict the risk of CHD in the non-diabetic population.

The foundation of glycemic control and therapy in diabetic patients is glycated haemoglobin (HbA1c), which has recently been recognised as a critical indicator for diagnosing diabetes and identifying those at risk of further development <sup>1</sup>. When compared to fasting or post-load blood glucose measurements, HbA1c has a higher dependability rate <sup>2</sup>. HbA1c is a suggested method for the diagnosis and screening of diabetes, and it can also accurately reflect blood glucose control obtained in the previous two to three months<sup>3,4</sup>. The Disease Coronary Atherosclerotic Heart Disease (CHD) has multiple underlying causes. Age, gender, cholesterol, hypertension, smoking, and diabetes are among the risk factors for coronary heart disease identified by the original Framingham Heart Study done in the US. <sup>5</sup>

## **MATERIALS AND METHODS**

**STUDY DESIGN:** It is a cross-sectional study.

**STUDY PERIOD:** It is a One and half year study from January 2021 to June 2022.

### **SOURCE OF DATA:**

1. The material of the present study will be collected from the patients who are admitted in BLDE (To be deemed) University Shri B M Patil Medical College Hospital and Research Centre, Bijapur who have symptoms of Coronary Heart Disease without Diabetes Mellitus will be included in the study.
2. Patients will be informed about the study, and written consent will be obtained.

### **INCLUSION CRITERIA:**

- Age between 18 To 80 Years.
- Sex: Both.
- Patient must give Written Consent to take part in the Study.
- Diagnosis of Coronary Artery Disease or any Anginal symptoms with either Diagnostic Electrocardiographic Changes.

**EXCLUSION CRITERIA:**

- Known case of Diabetes Mellitus.
- Patients who refuse to take part in the study.
- Patients having HbA1c level  $\geq 6.5$

**RESULT AND DISCUSSION**

The present study was a cross-sectional study. This Study was conducted at BLDE University Shri B M Patil Medical College Hospital and Research Centre, Bijapur from January 2021 to June 2022. Total 95 patients were included in this study.

In our study, out of 95 patients, most of the patients were [16 (16.8%)] 20-34 years of age. Age Category was not statistically significant with HBA1C Category ( $p=0.0622$ ). Distribution of mean Age with HBA1C Category was statistically significant ( $p=0.0050$ ).

We found that, male population [51 (53.7%)] was higher than the female population [44(46.3%)] but this was not statistically significant ( $p=0.0711$ ).

**Liu Y et al**<sup>6</sup>(2011) showed that Hemoglobin A1c's (HbA1c) predictive significance in coronary artery disease (CAD) is still debatable. Here, they carried out a systematic review to measure the relationship between high HbA1c levels and all-cause mortality in CAD patients who were hospitalised. For papers published between 1970 and May 2011, a thorough search of electronic databases (PubMed, EMBASE, OVID, Web of Science, and The Cochrane Library) was conducted.

**Ito H et al**<sup>7</sup> (2011) observed that to investigate the connection between type 2 diabetes mellitus in Japanese patients and hyperuricemia (HUA) clinical backgrounds. Following a cross-sectional study evaluating the association of HUA with the clinical characteristics in 1,213 patients with type 2 diabetes mellitus, an investigation into the estimated glomerular filtration rate (eGFR) and the prevalence of diabetic macroangiopathies was carried out in a prospective observational study involving 1,073 patients over a time period of 3.5 years. 299 subjects (or 25%) were found to have HUA during the cross-sectional examination.

It was found that, most of the patients had [36(62.1%)] K/C/O HTN in  $\geq 5.5$  group compared to  $<5.5$  group [16 (43.2%)] but this was not statistically significant ( $p=0.0961$ ) and we also found that, most of the patients had [22 (37.9%)]

SBP 140-159 in  $\geq 5.5$  group compared to  $< 5.5$  group [12 (32.4%)] it was not statistically significant ( $p=0.1555$ ).

Our study showed that, more number of patients had [24 (64.9%)] TC  $< 160$  in  $< 5.5$  group compared to  $\geq 5.5$  group [22 (37.9%)] but this was not statistically significant ( $p=0.0723$ ). Higher number of patients had [44 (75.9%)] HDL Category  $< 40$  in  $\geq 5.5$  group compared to  $< 5.5$  group [20 (54.1%)] it was not statistically significant ( $p=0.1719$ ). Most of the patients had [53 (91.4%)] High CRP Category in  $\geq 5.5$  group compared to  $< 5.5$  group [25(67.6%)] which was statistically significant ( $p<0.0001$ ).

**Masuda D et al<sup>8</sup> (2012)** examined that the postprandial buildup of chylomicrons and chylomicron remnants is one aspect of postprandial hyperlipidemia (CM-R). By using multiple logistic regression analysis, they attempted to ascertain which metabolic factors were associated with the prevalence of CAD and whether or not the concomitant presence of high apo B-48 and other coronary risk factors (high triglyceride, low HDL-C, high HbA1c, or low adiponectin levels increased the prevalence of CAD.

We showed that, majority number of patients were smoker [31 (53.4%)] in  $\geq 5.5$  group compared to  $< 5.5$  group [12 (32.4%)] though it was statistically significant ( $p=0.0447$ ). More number of patients had [30 (51.7%)] Intermittent in  $\geq 5.5$  group compared to  $< 5.5$  group [20 (54.1%)] which was statistically significant ( $p=0.0232$ ). Association of 10 Year CVD Risk % gr with HBA1C Category was statistically significant ( $p=0.0171$ ).

We observed that, the mean BMI kg/m<sup>2</sup> was more [27.0293 $\pm$ 4.5381] in  $\geq 5.5$  group compared to  $< 5.5$  group [24.6081 $\pm$ 5.1724] it was statistically significant ( $p=0.0184$ ). The mean FBS mg/dL was more [124.6207 $\pm$ 40.2705] in  $\geq 5.5$  group compared to  $< 5.5$  group [118.7568 $\pm$ 43.7070] but this was not statistically significant ( $p=0.5049$ ).

**Ashraf H et al<sup>9</sup>(2013)** examined that to determine the relationship between glycated haemoglobin (HbA1c) and the severity of non-diabetic people's coronary artery disease (CAD) as determined by angiograms. The participants with both hsCRP and HbA1c in the higher 2 quartiles had the highest adjusted ORs for the development of CAD (OR: 4.183; 95% CI: 1.883-9.290,  $p$  0.0001). Gensini score and rising HbA1c tertiles were significantly correlated ( $p = 0.038$ ). HbA1c 5.6% 38 mmol/mol) (sensitivity: 60.5%, specificity: 52%) was the optimum cut-off value for

predicting the development of CAD. HbA1c could be used to stratify CAD risk in non-diabetic people, independent of conventional cardiovascular risk factors, insulin resistance, and inflammatory markers.

In our study, the mean PPBS mg/dL was higher [176.4828±57.3568] in  $\geq 5.5$  group compared to  $< 5.5$  group [165.4865±54.7300] it was not statistically significant ( $p=0.3561$ ). The mean SBP and DBP mm/Hg was more [147.1379±22.4378], [87.7931±10.2645] in  $\geq 5.5$  group compared to  $< 5.5$  group [138.8108±21.6048], [85.4054±10.8409] it was not statistically significant ( $p=0.2822$ ). Distribution of mean TC-mg/dL with HBA1C Category was not statistically significant ( $p=0.0665$ ).

We found that, the mean TG-mg/dL was higher [171.9655±79.2367] in  $\geq 5.5$  group compared to  $< 5.5$  group [117.8649±50.2859] which was statistically significant ( $p=0.0004$ ), the mean LDL-mg/dL was more [96.2241±51.3680] in  $\geq 5.5$  group compared to  $< 5.5$  group [69.3514±53.1111] which was statistically significant ( $p=0.0160$ ) and the mean HDL- mg/dL was lower [35.4310±13.5894] in  $\geq 5.5$  group compared to  $< 5.5$  group [38.4595±17.2508] but this was not statistically significant ( $p=0.3433$ ). Distribution of mean HBA1C % with HBA1C Category was statistically significant ( $p<0.0001$ ).

Our study showed that, the mean CRP mg/L was more [33.7985±19.7337] in  $\geq 5.5$  group compared to  $< 5.5$  group [18.4303±21.6220] it was statistically significant ( $p=0.0020$ ). The mean FRS was higher [16.8793±7.0414] in  $\geq 5.5$  group compared to  $< 5.5$  group [10.7838±9.8577] it was statistically significant ( $p=0.0007$ ). Distribution of mean 10 year CVD RISK % with HBA1C Category was statistically significant ( $p=0.0083$ ).

**Zhao W et al**<sup>10</sup> (2014) found that clinical trials to date have not provided definitive evidence regarding the effects of glucose lowering with coronary heart disease (CHD) risk among diabetic patients. They prospectively looked into the relationship between baseline and follow-up HbA1c levels and the risk of CHD among 12,592 white and 17,510 African American patients with type 2 diabetes. 7,258 incident CHD cases over a 60-year follow-up on average were found. The multivariable-adjusted hazard ratios of CHD were 1.00, 1.07 (95% CI 0.97-1.18), 1.16 (1.04-1.31), 1.15 (1.01-1.32), 1.26 (1.09-1.45), 1.27 (1.09-1.48), and 1.24 (1.10-1.40) (P

trend = 0.002) for African Americans and 1.00, 1.04 (0.94 -1.14), 1.15 (1.03-1.28), Both African American and white diabetes individuals showed a graded connection between follow-up HbA1c and CHD risk (all P trends 0.001).

It was found that, the positive correlation was found between HBA1C % vs AGE [.337] and the result was statistically significant (p.001). The positive correlation was found between HBA1C % vs BMI kg/m<sup>2</sup>, the result was statistically significant (p.007). The positive correlation was found between HBA1C % vs FBS mg/dL [.166].The P-Value was (p.107). The result was not statistically significant.

We showed that, the positive correlation was found between HBA1C % vs PPBS mg/dL[.129]. The P-Value was (p.212). The result was not statistically significant. The positive correlation was found between HBA1C % vs SBP mm/Hg [.338]. The P- Value was (p.001). The result was statistically significant. The positive correlation was found between HBA1C % vs DBP mm/Hg [.247]. The P-Value was (p.016). The result was statistically significant.

We observed that, the positive correlation was found between HBA1C % vs TC-mg/dL [.180]. The P-Value was (p.081). The result was not statistically significant. The positive correlation was found between HBA1C % vs TG-mg/dL [.321]. The P- Value was (p.002). The result was statistically significant. The positive correlation was found between HBA1C % vs LDL-mg/dL [.278]. The P-Value was (p.006). The result was statistically significant.

In our study, the Negative correlation was found between HBA1C % vs HDL-mg/dL [.074]. The P-Value was (p.478). The result was not statistically significant. The positive correlation was found between HBA1C % vs FRS [.426]. The P-Value was <0.0001. The result was statistically significant.

## CONCLUSION

- In our study, out of 95 patients, most of the patients were 20-34 years of age.
- Age Category was not statistically significant with HBA1C Category. Distribution of mean Age with HBA1C Category was statistically significant.
- We found that, male population was higher than the female population and male: female ratio was 1.15:1 but this was not statistically significant.
- It was found that, most of the patients had K/C/O HTN in  $\geq 5.5$  group compared to  $< 5.5$  group but this was not statistically significant and we also found that, most of the patients had SBP 140-159 in  $\geq 5.5$  group compared to  $< 5.5$  group it was not statistically significant.
- Our study showed that, more number of patients had TC  $< 160$  in  $< 5.5$  group compared to  $\geq 5.5$  group but this was not statistically significant. Higher number of patients had HDL Category  $< 40$  in  $\geq 5.5$  group compared to  $< 5.5$  group it was not statistically significant. Most of the patients had High CRP Category in  $\geq 5.5$  group compared to  $< 5.5$  group which was statistically significant.
- We showed that, majority numbers of patients were smoker in  $\geq 5.5$  group compared to
- $< 5.5$  group though it was statistically significant. More number of patients had Intermittent in  $\geq 5.5$  group compared to  $< 5.5$  group which was statistically significant. Association of 10 Year CVD Risk % gr with HBA1C Category was statistically significant).
- We observed that, the mean BMI kg/m<sup>2</sup> was more in  $\geq 5.5$  group compared to  $< 5.5$  group it was statistically significant. The mean FBS mg/dL was more in  $\geq 5.5$  group compared to  $< 5.5$  group but this was not statistically significant.
- In our study, the mean PPBS mg/dL was higher in  $\geq 5.5$  group compared to  $< 5.5$  group it was not statistically significant. The mean SBP and DBP mm/Hg was more in  $\geq 5.5$  group compared to  $< 5.5$  group it was not statistically significant. Distribution of mean TC-mg/dL with HBA1C Category was not statistically significant.
- We found that, the mean TG-mg/dL was higher in  $\geq 5.5$  group compared to  $< 5.5$  group which was statistically significant, the mean LDL-mg/dL was more in  $\geq 5.5$  group compared to  $< 5.5$  group which was statistically significant and the mean HDL-mg/dL



was lower in  $\geq 5.5$  group compared to  $< 5.5$  group but this was not statistically significant. Distribution of mean HBA1C % with HBA1C Category was statistically significant.

- Our study showed that, the mean CRP mg/L was more in  $\geq 5.5$  group compared to  $< 5.5$  group it was statistically significant. The mean FRS was higher in  $\geq 5.5$  group compared to  $< 5.5$  group it was statistically significant. Distribution of mean 10 year CVD RISK % with HBA1C Category was statistically significant.
- It was found that, the positive correlation was found between HBA1C % vs AGE and the result was statistically significant. The positive correlation was found between HBA1C % vs BMI kg/m<sup>2</sup>, the result was statistically significant. The positive correlation was found between HBA1C % vs FBS mg/dL. The result was not statistically significant.
- We showed that, the positive correlation was found between HBA1C % vs PPBS mg/dL. The result was not statistically significant. The positive correlation was found between HBA1C % vs SBP mm/Hg. The result was statistically significant. The positive correlation was found between HBA1C % vs DBP mm/Hg. The result was statistically significant.
- We observed that, the positive correlation was found between HBA1C % vs TC-mg/dL. The result was not statistically significant. The positive correlation was found between HBA1C % vs TG-mg/dL. The result was statistically significant. The positive correlation was found between HBA1C % vs LDL- mg/dL. The result was statistically significant.
- In our study, the Negative correlation was found between HBA1C % vs HDL-mg/dL. The result was not statistically significant. The positive correlation was found between HBA1C % vs FRS. The result was statistically significant.

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**Table: Association between CRP CATEGORY: HBA1C CATEGORY**

<b>HBA1C CATEGORY</b>			
<b>CRP Category</b>	<b>&lt;5.5</b>	<b>≥5.5</b>	<b>TOTAL</b>
<b>High</b>	12	53	65
Row %	18.5	81.5	100.0
Col %	32.4	91.4	68.4
<b>Normal</b>	25	5	30
Row %	83.3	16.7	100.0
Col %	67.6	8.6	31.6
<b>TOTAL</b>	37	58	95
Row %	38.9	61.1	100.0
Col %	100.0	100.0	100.0

**Table: Distribution of mean HBA1C %: HBA1C CATEGORY**

		<b>Number</b>	<b>Mean</b>	<b>SD</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Median</b>	<b>p-value</b>
<b>HBA1C %</b>	<5.5	37	.0497	.0039	0.0400	0.0540	0.0510	<0.0001
	≥5.5	58	.0604	.0029	0.0550	0.0640	0.0610	