J Cardiovasc Disease Res., 2019;10(2):65-67
A Multifaceted Peer Reviewed Journal in the field of Cardiology
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Case Report

Correlation Between BMI, Hba1c And Fasting Lipid Profile in Patients Presenting with Acute Coronary Syndrome and Their Relationship with CVD Risk

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ABSTRACT

Context: Cardiovascular Disease has been historically correlated with Diabetes, Obesity and increased circulating lipids. HbA1c is a reliable marker of Diabetes as well as being used to predict the occurrence of macro and micro vascular complications. BMI is a measure of the body fat and the Fasting lipid profile is an essential part of any CVD prevention. **Aims:** This study aimed to reveal the correlation of HbA1c with BMI, Fasting lipid profile and to compare them with the predicted CVD risk. Settings and **Design:** The study subjects were part of a Cross sectional validation study to compare different Cardiovascular Disease risk score calculators in a Tertiary care hospital. **Methods and Material:** A total of 773 people presenting with Acute Coronary Syndrome were selected and their baseline characteristics, laboratory parameters analyzed. **Statistical analysis used:** The statistical analysis was done by calculating the p value with the Chi square test. Results: The Chi square test gave an insignificant p value of 0.9783 which shows that the higher HbA1c does not translate to a higher BMI. **Conclusions:** The BMI and the HbA1c correlated with the LDL in the Lipid profile. The BMI and HbA1c individually correlated well with a high risk of developing acute Coronary Syndrome. Thus, the take home message is, a normal BMI does not guarantee a decreased Cardiovascular risk in the Indian population due to the prevalence of metabolic obesity.

Key-words: BMI, HbA1c, Acute coronary syndrome, Type 2 diabetes mellitus, Fasting lipid profile

Key Messages: The concept of Diabetes being related to obesity, no longer applies in this era of Metabolically obese. The utility of BMI in determining Cardiovascular risk of a population is to be discouraged and those with a normal BMI should be screened for other significant risk factors of Coronary Artery Disease.

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Submitted: 10-03-2019
Revision: 24-03-2019
Accepted date: 20-05-2019

DOI: 10.5530/jcdr.2019.1.12

INTRODUCTION

It has been seen that among all the disease, worldwide, cardiovascular diseases (CVD) are among those that are the leading causes of mortality and morbidity with a prevalence that is seen to be increasing day by day. The incidence of this symptomatic CAD is exerting a negative effect on the quality of life and healthcare economics. Thus, there is an increase in the awareness of underlying causes of CVD, as well as improvements in treatment of atherosclerosis which has now resulted in a shift in focus from treatment to prevention of Symptomatic CVD. Hence, the recognition of those at risk of developing CAD and subsequent events is essential in the prevention strategies.[1]

CVD is a result of progression of the atherosclerotic process which beings early in life and usually has a prolonged latency period before manifestation. It is projected to kill approximately 24 million by 2030.[2]

The demographic profile of this disease is altering and people of all social strata are subject to the risk factors and their consequence like Cardiovascular disease.[3] The concept behind developing a risk prediction system is that moderate increase in more than one risk factor translates to a greater risk for disease than a single grossly elevated risk factor.[4]

It was seen from the INTERHEART case-control study that elevated blood pressure, abnormal lipids, smoking, abdominal obesity, diabetes, psychosocial factors (all harmful), and consumption of fruit, vegetables and regular physical activity (all protective) account for over 90% of the population attributable risk of MI worldwide.[5]

Of all the variety of clinical, biochemical and other risk factors used to predict the occurrence of CVD, endothelial dysfunction has great importance as it has been proven to be linked to the development of atherogenesis.[6] And the clinching point in the identification of this is that it has a long asymptomatic stage.[7]

Diabetes mellitus is a group of metabolic diseases which is characterized by hyperglycemia due to defects in insulin secretion, insulin action, or both. Chronic hyperglycemia seen in Type 2 diabetes causes long-term damage, dysfunction and organ impairment. The major organs affected are eyes, kidneys, nerves, heart, and blood vessels.[8] A majority of the people with Diabetes succumb to heart disease and stroke. About 382 million people are diagnosed as diabetics in 2013 and this number will exponentially increase to 592 million by 2035. Of these about 175 million people remain undiagnosed and most of them are type 2 Diabetics. Enough studies have shown that the insulin resistance is a major risk factor in development of Type 2 Diabetes.[9] The importance is seen in the fact that among the CVD deaths there are a greater number of people who are non-diabetic but have been found to have insulin resistance and metabolic syndrome. The BMI measured by the Quetelet index is commonly used to classify the people into Normal, Overweight or Obese with each group carrying specific CVD risks.[8] The Glycated haemoglobin (HbA1c) is now being used as a marker for long-term glycaemic control. It has also been included as a diagnostic modality in the ADA guideline and also predicts the occurrence of Macrovascular and Microvascular complications in Diabetics. Likewise, the lipid profile is an essential tool, as an early reduction in circulating lipids confers CVD protection. This study was done with the intention of comparing the BMI measured by the Quetelet index, HbA1c and Fasting lipid profile in people with established CVD.

SUBJECTS AND METHODS

The patients were picked up from a study comparing the Cardiovascular risk score calculators which included a total of 1000 patients with Acute Coronary Syndrome. A total of 773 people with HBA1C values were selected and their baseline characteristics analysed. Data were collected using a pre-tested proforma meeting the objectives of the study. Detailed demographic details of the patient, including age, gender, diabetic history, anthropometric details were collected. Weight was measured with electronic digital scales and height with wall-mounted stadiometer. The BMI was calculated using the Quetelet formula as weight (kg) per height (m2). Five ml of venous blood were collected (in fasting state), venous blood was drawn into plain vacutainers, and then

centrifuged and serum was separated. The sera were used to measure the concentration of HbA1c and lipid profile using spectrophotometric methods. Results of this study were entered and managed on Microsoft Excel and the statistically analysis was done using statistical package for social science (SPSS) program. The statistical analysis was done by calculating the p value with the Chi square test.

RESULTS

The baseline characteristics of the study population are given in Table 1. A total of 773 people was included in this study of which 563 were male and 210 were female. 513 were known cases of Diabetes mellitus and the 260 were non-diabetic. The average age was 63 ± 10.8 years. The average BMI was 25 ± 4.4%. The average HbA1c was 7.41 ± 1.8. For ease of analysis, the Moderate obese, severely obese, very severely obese and morbidly obese were categorised as Obese. A total of 387 (52.7%) had a normal BMI. 34.9 % were Overweight and 12.4 were obese, the exact breakup is given in Table-1. The Fasting lipid profile was also analysed and the average Total Cholesterol was 175 ±49.99, HDL- 40 ± 12.72 and the LDL was 112 ± 42.54. The rest of the values are given in Table 1. The average BMI in the Diabetic population was 26 ± 4.3while the average in the non-diabetic population was 25 ±4.5 (Ref- Table-4). While the average HbA1c was higher in the Diabetic population (8 ± 1.7) compared to the Non Diabetic Population (6.2 ± 1.4) (Ref Table-4), the p value for correlation between BMI and HbA1c as calculated by the Chi Square test was not significant (0.9783) as shown in Table 2. And individually the BMI and the HbA1c were compared with the Fasting Lipid Profile and only the LDL showed a significant p value (0.021, 0.0208) for comparison with the BMI and HbA1C respectively. The rest of the p values are given in Table 5. It was seen that the average HbA1C in all the three categories of the BMI was more or less the same (7.38, 7.47 and 7.39) as given in Table 3. Both the BMI and the HbA1C were compared with 4 different scoring systems for high risk of CVD in the study and was found to be significant (ref. Table 6).

Table 1: Baseline Characteristics of the Study Population.

Parameters		Values
Age (Years)		63 ± 10.8
Gender	Male	563
	Female	210
BMI (%)		
	Normal	387
	Over weight	270
	Class 1 Obese	77
	Class 2 Obese	32
	Class 3 Obese	7
HbA1c (%)		7.41 ± 1.8
T. CHOL (mg/dL)		175 ± 49.99
TG (mg/dL)		137 ± 62.17
HDL (mg/dL)		40 ± 12.72
LDL (mg/dL)		112 ± 42.54
VLDL(mg/dL)		27 ± 13.9

Table 2: Correlation Between BMI and HbA1c.

BMI (%)	HbA1C (%)		p Value
	Normal n=293 (37.9%)	Abnormal n=480 (62.1%)	
Normal n= 387	148	239	0.9783
Overweight n= 270	102	168	
Obese n= 116	43	73	

Table 3: Comparison between BMI and Average HbA1c.

BMI (%)	Average HbA1c (%)
Normal	7.38
Over Weight	7.47
Obese	7.39

Table 4: Comparison between the averages of BMI and HbA1c in Diabetic and Non diabetic population.

	Non Diabetic (n= 514)	Diabetic (n=259)
BMI (Average) (%)	25 ± 4.5	26 ± 4.3
HbA1c (Average) (%)	6.2 ± 1.4	8 ± 1.7

Table 5: Comparison of p values Between BMI, HbA1c and the Fasting Lipid Profile.

	p value				
	T. CHOL (mg/dL)	TGL (mg/dL)	HDL (mg/dL)	LDL (mg/dL)	VLDL (mg/dL)
BMI (%)	0.8894	0.1102	0.1833	0.021	0.4969
HbA1c (%)	0.03354	0.7461	0.3068	0.0208	0.4254

Table 6: Comparison between BMI, HbA1C and CVD Risk Score Calculators Prediction Of High Risk of CVD.

	p Value			
	FRS	WHO	ACC/AHA	JBS-3
BMI (%)	0.042	0.046	0.015	0.026
HBA1C (%)	<0.001	<0.001	<0.001	<0.001

DISCUSSION

It is seen from this study that the HbA1c does not correlate with the BMI as previously reported in several studies.[9,10] It was noted that HbA1c is a potential dual marker of glycaemic control, dyslipidemia in those presenting with type 2 diabetes.[11] A study showed in Western Indian population that obese subjects with dyslipidemia were found to have a significant linear association with HbA1c.[12] Thus it was postulated that early diagnosis of dyslipidemia can be used as prevention for cardiovascular disease (CVD) in type 2 diabetics. Another study opined that the HbA1c can provide data regarding the levels of the circulating lipids apart from glycemic information.[13] However this has been refuted in this study as the HbA1c level has not correlated with the Fasting lipid profile as well, except for with the LDL Cholesterol. Thus, the utility of HbA1c as a dual biomarker is questionable when the Fasting Lipid profile is much more reliable. Also, the prediction of a person's Lipid status based on the HbA1c might be misleading and result in type 2 error.

Obesity is critical in the pathophysiology of Type2 diabetes and the associated macro vascular complications.[11] And epidemiologic research of CVD risk factors in diabetic patients and different BMI ranges should provide clues about the relationship between obesity and its contribution to CVD risk especially in Type 2 Diabetics. A great many of the population had a normal BMI suggesting the presence of additional risk factors excluding the body habitus in the development of ACS. In our study we have highlighted that even though the BMI was found to correlate well with a higher risk for developing ACS, the the majority of the population actually had a normal BMI. The concept of CVD being a disease of exclusively the "Fat" is a thing of the past as we have come to terms with the evolution of the "Metabolically obese" as seen by the prevalence of people with a normal BMI and high risk of CVD due to the presence of additional CVD risk factors increasing in the population. Thus, the measure of the BMI should no longer be considered a yard stick for screening of CVD and should play only a supporting role. This is confirmed by the fact that BMI had significant correlation with a higher CVD risk but the average BMI in the study

population was normal and was found to be almost identical in Diabetic and Non-Diabetic population. Also, the HbA1c was identical in all the different BMI groups which can also be explained by the presence of Diabetic and Non-diabetic population in each group. With regards to the Lipid profile as well, the Normal BMI category had higher Total cholesterol, LDL, VLDL and Triglycerides while the distribution of BMI was equal in both normal and low HDL groups. The presence of a low HDL levels has been related with increased fractional clearance of HDL. Due to the presence of obesity the enzymes involved in HDL metabolism are altered due to insulin resistance. And such changes are seen to reflect in the Type 2 Diabetic population. Thus, the HDL cholesterol may serve as a tool for the prediction of risk of CVD in especially the young population.[14-16]

The HbA1c and the BMI are individually and together wonderful tools for the prediction of CVD risk in a person. However, the categorization of a person as low risk for metabolic syndrome, which is itself a CVD risk in those with normal BMI, is detrimental. Thus, primary screening should afford BMI a low Specificity and a high Sensitivity and further evaluation for other significant risk factors need to be carried out for appropriate CVD risk detection.

ACKNOWLEDGEMENT

We thank the Department of General Medicine and the Department of Cardiology and the entire Faculty and staff members for the guidance. We thank Dr. Prem Nair, the Medical Director, Dr. (Col) Vishal Marwaha, the Principal, Dr. Sanjeev Singh, Thesis Review Committee and Ethics Committee for permitting me to carry out my study in AIMS Kochi. Our thanks to Professor K.R. Sundaram, H.O.D., Department of Biostatistics, Mrs. Renjitha and Ms Greeshma for helping us with the statistical analysis.

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Cite this article : Gnanaguru D, Oommen AT, Pillai G. Correlation Between BMI, Hba1c And Fasting Lipid Profile in Patients Presenting with Acute Coronary Syndrome and Their Relationship with CVD Risk. J Cardiovasc Disease Res. 2019;10(2):65-67