Original Article

High sensitive-CRP in IGT regular body weight smokers and IGT nonsmoker obese adult male patients as a predictor of higher risk group

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ABSTRACT

Background: Impaired glucose tolerance (IGT) is associated with an increased cardiovascular disease risk. Less is known about cardiovascular disease risk among subjects with impaired fasting glucose (IFG). Metabolic diseases are affecting human health all over the world. These chronic subclinical disease states are associated with highly sensitive CRP. **Objective:** The present study aims to measure hs-CRP as a marker in adult IGT (impaired glucose tolerance) patients explore its relationship to smoking of normal body weight person and obesity of non smoker person to compere and predict the higher risk group for future development of CVD and diabetes. **Methodology:** A total of 40 adults, age 30-60 years, healthy IGT subjects were recruited in this study. We were taken the measurement of blood glucose, hs-CRP levels, BMI and smoking history. Statistical Package for Social Program (SPSS) was used for data analysis by using Windows version 17. Results were expressed as mean±SD. Student's 't' test was done to see the difference, and $p <0.05$ was considered significant. **Results:** The mean BMI of group I was 22.1±2.3, and group II was 33.3±2.5, indicating strong statistical significance. The mean and average serum levels of hs-CRP in smoker IGT and obese IGT subjects were 3.55±1.46 (0.39- 3.68) and 4.13±1.63 (0.48-4.4) mg/L, respectively, with a cut-off value of 3mg/l. The total 40 subjects had hs-CRP above the cutoff value. Hs-CRP was almost similarly high in both groups. However, there is no significant difference between IGT smokers (with normal body weight) and IGT obese (nonsmoker) subjects. **Conclusion:** The prevalence of risk factors for CVDs and diabetes is high in Bangladesh. In this study, all IGT regular body weight smoker patients and IGT obese nonsmoker patients have moderately high levels of hs-CRP. Therefore, both the IGT regular body weight smoker group and the IGT obese nonsmoker group were in the high-risk group. However, here, IGT smokers and the IGT obese group did not significantly differ from each other as a higher high-risk group.

Keywords: High sensitivity C-reactive protein, IGT, obesity, smokers.

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Introduction

The World Health Organization has defined pre-diabetes as a state of intermediate hyperglycemia. The criteria by Buysschaert and Bergman (2011) for fasting plasma glucose (FPG) are 110 to 125 mg/dL, and for impaired oral glucose tolerance (IGT) is 140 to 199 mg/dL.[1] Individuals with pre-diabetes are at a higher risk for progression to diabetes and are also known to be associated with an increased risk of

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cardiovascular disease. Also, pre-diabetes is known to be associated with obesity and a deranged lipid profile.[2] C-reactive protein (CRP) is an acute-phase protein that is increased in infections, inflammatory conditions, and even cancers.[3-4] Hs-CRP can measure trace amounts of CRP in the blood, and its analytical precision, accuracy and availability make it suitable for CVD risk assessment[5]. High sensitive CRP (hs-CRP) is a highly sensitive form of CRP. It is detected by highly sensitive assays and can detect hs-CRP levels sensitively between 0.01 mg/L and 10 mg/L. Thus, these assays can detect even low-grade inflammation without evident inflammation[3]. Normal hs-CRP levels are less than 10 mg/L. In acute conditions, hs-CRP levels rise sharply to more than 10 mg/L. Also, high sensitivity CRP > 1 mg/L is known to be associated with a mild risk of cardiovascular disease, while levels 1-3 mg/L represent moderate risk and > 3 mg/L represent high risk.[3] Low-grade inflammation is said to be associated with pre-diabetes. Hs-CRP is an indicator of inflammation. Several studies have been reported on the association of hs-CRP and cardiovascular disease.[6] Furthermore, even fewer studies have been done on the relation between hs-CRP and pre-diabetes.[7] There is enough evidence pointing out the stronger relationship between IGT and cardiovascular morbidity and mortality, while the relationship between IFG and cardiovascular disease is still unclear and controversial.[8] Body mass index (BMI) is widely used to measure relative adiposity among children and adults.[9] Obesity is a chronic low-grade inflammation that increases CRP.[10] Smoking elicits several deleterious health consequences, including low-grade inflammation, which is characterized by an elevated plasma hs-CRP.[11] This is an important issue since increased hs-CRP levels are associated with elevated cardiovascular risk and higher mortality rates.[12] Higher hs-CRP test results are often found among patients at risk of cardiovascular incidents who have no prior history of CVD.[13] The extent to which observed associations between high-sensitivity C-reactive protein (hs-CRP) and incident diabetes are explained by obesity and smoking remains unclear in IGT. As there are few studies on this topic, especially in the Bangladeshi population, we intend to study hs-CRP in pre-diabetes IGT of (normal body weight) smokers and (nonsmoker) obese to explore the higher risk group for future development of CVD and diabetes.

Methods

The study was carried out in the Department of Biochemistry, ZHSWMC, Dhaka, during July 2018 to June 2019. This study aimed to evaluate and compare levels of serum HS-CRP in IGT smoker (normal body weight) individuals as a group I and IGT obese (nonsmoker) subjects (BMI > 30 kg/m^2) as group II. In this Out Patient Department based cross sectional study, we selected 20 IGT smoker parsons and another 20 ages & sex matched IGT with obesity individuals. Age of group I and group II was 18 to 50 years. Smoking habit was obtained by a face-to-face interview. Twenty apparently healthy (BMI 18.5-24.9) male regular cigarette smokers aged 18-50 years who smokes at least 5-10 sticks of cigarette per day for duration of 5-10 years were included as study group I. Anthropometric measurements, Body Mass Index (BMI) was calculated as Body weight (Kg)/ Height (m)^2 where BMI > 30 were eligible for 20 obese participants in group II. Here WHC are not measured. Informed consent was obtained from the participants, and data confidentiality was assured.

Biochemical measurements

Glucose tolerance was studied during an oral glucose tolerance test (OGTT), and 2006 WHO criteria were applied based on fasting plasma (<110mg/dl) and 2-hour glucose levels (140-199mg/dl). 5 ml venous blood samples were drawn. High sensitivity CRP (hs-CRP) is the measure of C-reactive protein with greater accuracy and the lower limit of its assay is .01 mg/L which is more than 100 times as sensitive as the usual CRP measurement. In clinical laboratory of Biochemistry department, hs-CRP was determined in serum by immunonephelometric principle using BNII Systems, Dade Behring, USA. Exclusion criteria for entry into the study were sustained hypertension, dyslipidemia, renal failure, heart failure, peripheral vascular disease, acute or chronic infection, cancer, and hepatic disease and type 2 diabetic patients.

Statistical analysis

Statistical analysis was done by SPSS statistical software. The values were reported as mean +/- SD. Student's t-test as appropriate to compare two groups. P<0.05 was accepted as statistically significant.

Result

Present study was aimed to evaluate and compare levels of serum hsCRP in smoker IGT parsons and

obese IGT individuals. The main characteristics of study population are reported in the Table below. Age, gender distribution, and serum glucose did not differ among the two groups by selection. The mean BMI of group I was 22.1±2.3, and group II was 33.3±2.5. Metabolic parameters were not different among the study groups due to the selection process (Table). The mean and average serum levels of hs-CRP in smokers and obese IGT subjects were 3.55±1.46 (0.39- 3.68) and 4.13±1.63 (0.48-4.4) mg/L, respectively. There were not significantly higher hs-CRP levels in IGT smoker patients with IGT obese subjects (p> 0.1). The levels of serum hs-CRP were high related to 2 hours after glucose in the smoker and obese IGT groups (p> 0.01) (Table 1).

Table 1: Demographic and biochemical parameters of study participants (n=40)

Variables	Group I(smoker IGT) (Mean+/-S.D.)n= 20	Group II(Obese IGT) (Mean+/-S.D.)n= 20	t value	P value
Age (years)	39.8± 6.2	42.2±2.1	1.6438	p>0.1
BMI (kg/m2)	22.1 ±2.3	33.3±2.5	3.297	P<0.01
Fasting blood sugar (mg/dl)	82.4±10.4 (69-95)	86.2±9.2 (71-103)	1.25	p>0.1
2 hours after glucose (mg/dl)	164±15.5 (148-182)	170±16.4 (152-191)	1.1857	p>0.1
Serum hs-CRP (mg/L)	3.55±1.46*(0.39- 3.68)	4.13±1.63 (0.48-4.4)	1.234	p>0.1

Unpaired students `t' test = statistically not significant* p value >0.1, highly significant ** p<0.0001.

Discussion

High-sensitive C-reactive protein has been a subject of interest among researchers in recent times. CRP is an acute-phase reactant produced mainly by the hepatocytes in response to inflammatory stimuli. It is a sensitive nonspecific biomarker of systematic inflammation.[14] The circulating value of CRP reflects ongoing inflammation and/or tissue damage[14] and is associated with cardiovascular disease, type 2 diabetes, smoking, and a sedentary lifestyle.[15] In a study, some found hs-CRP as a definite predictor of inflammation in pre-diabetes, which was the primary outcome. Azar and Richard, in a study evaluating salivary C-reactive protein levels in the context of tobacco smoke exposure, found that hs-CRP values were higher in active smokers when compared to passive or nonsmoking smokers.[16] The Relationship of hs-CRP with prediabetes has not been explored extensively in Bangladesh. In the present study, we demonstrated the relationship between hs-CRP levels and IGT in Bangladesh. Here, the mean of BMI of group I was 22.1±2.3 and group II was 33.3±2.5, indicating strong statistical significance. We found that the strength of the association of hs-CRP with IGT is higher. Both smokers and obese IGT individuals have higher levels of hs-CRP; their mean and average serum levels of hs-CRP in smoker IGT and obese IGT subjects were 3.55±1.46 (0.39- 3.68) and 4.13±1.63 (0.48-4.4) mg/L, respectively. Both groups of subjects have moderately high levels of hs-CRP. Hence, they are both in high-risk groups for future development of CVD and diabetes. There were not significantly higher hs-CRP levels in IGT smoker patients in contrast with IGT obese subjects (p> 0.1).

Conclusion

These results indicate that there are no significant differences in obesity and smoking variables with IGT. Both IGT smokers and obese persons are associated with increased cardiovascular risk as assessed hs-CRP levels. The risk is not different in these two categories, along with IGT. These two groups should be further characterized by more atherogenic risk profile

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