ASSESSMENT OF INFLAMMATORY STATUS IN TYPE 2 DIABETES MELLITUS PATIENTS

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ABSTRACT

Objective: The metabolic disorder, Type 2 diabetes mellitus (T2DM), is a major health problem which is the risk factor for the development of cardiovascular disease, cerebrovascular accident, renal failure, and other macrovascular diseases. Inflammation is the major pathogenesis of all the above conditions. Therefore, there is a need to assess the inflammatory status using simple and reliable marker which would help to diagnose the disease and assess the prognosis of the disease. Hence, the aim of the current study is to estimate the level of simple inflammatory marker, C-reactive protein (CRP) in Type 2 diabetes individual.

Materials and Method: Fifty patients, reporting to Saveetha Dental College and Hospitals, were enrolled in the study which includes 25 patients with T2DM and 25 healthy individuals. 5 ml of venous blood was collected and centrifuged. Then, it is analyzed for fasting blood sugar (FBS), glycated hemoglobin (HbA1c), and CRP using the standard kit method. The data obtained were subjected to statistical analysis using the SPSS software.

Results: The mean FBS, HbA1c, and CRP levels were higher in T2DM patients in comparison to healthy individuals. The serum FBS, HbA1c, and CRP levels in the control group and T2DM group were 85.08±8.47, 4.27±0.63, and 6.51±0.83 and 168, 7.38±0.9, and 27.23±19.06, respectively. There was a significant (p=0.000) difference in the mean CRP levels of the above groups.

Conclusion: CRP level were consistently higher in T2DM individuals; hence, it could be a simple and reliable marker to assess the inflammatory status of the diabetic individuals.

Keywords: C-reactive protein, Type 2 diabetes mellitus, Inflammation, Fasting blood glucose, Glycated hemoglobin.

INTRODUCTION

India has the distinction of having the highest number of type 2 diabetes mellitus (T2DM) individuals worldwide, with the prevalence of 11.6% in the urban population [1,2]. Furthermore, Asian Indians are known to be at a high risk for T2DM, cardiovascular disease, and metabolic syndrome [3]. In Chennai city, the prevalence had increased from 5.2% in 1984 to 14.3% in 2003 was reported [4]. The Indian Council of Medical Research India Diabetes Study showed that India had 62.4 million people with diabetes in 2011. This may increase to 101.2 million by 2030 [5]. Even though there is the development of high medical and diagnostic facilities, many studies show that diabetes is highly prevalent in the rural population. Among them newly diagnosed diabetes is high. Such persons are at the risk of development of complications [6].

DM is a metabolic disorder characterized by the presence of chronic hyperglycemia, insulin resistance, impaired regulation of hepatic glucose production, and declining beta cell function eventually leading to beta cell failure [7]. Inflammation plays a major role in the development of many systemic diseases such as DM, hypertension, cardiovascular disease, and cerebrovascular accidents. Diabetes itself is risk factors for the development of many other diseases such as cardiovascular disease, stroke, renal failure, and other micro and macrovascular diseases [8]. There are many inflammatory markers. One of the inflammatory markers is C-reactive protein (CRP), which is an acute-phase reactant produced by the liver and it is an extremely sensitive marker of systemic inflammation and also powerful predictor of cardiovascular disease [9-11]. CRP and acute phase-response were first discovered in 1930, as precipitation was observed with addition of pneumococcal C-polysaccharide to serum of a patient with pneumonia [12]. Synthesis of CRP is regulated primarily by interleukin-1, interleukin-6, and tumor necrosis factor-α. These proinflammatory cytokines are related closely to the impaired glucose metabolism and insulin resistance [13]. Glucose metabolism and insulin resistance are the key features and major cause of development of DM. CRP is even more relevant in Asian Indians who are at high risk for the development of insulin resistance, T2DM, and coronary heart disease [14].

Hence, estimation of the level of serum CRP in DM individual is useful in clinical practice to diagnose the severity and prognosis of the disease condition and select the appropriate therapeutic option.

MATERIALS AND METHODS

Patients were selected from those attending the outpatient Department of Saveetha Dental College and Hospitals and divided into two groups as follows

Group I - Normal healthy individuals – 25 individuals.
Group II - Patients with T2DM – 25 individuals.

Inclusion criteria
- Individuals with the age group of 35–55 years.
- Individuals with T2DM.

Exclusion criteria
- Individuals with other systemic illness such as cardiovascular disease, renal failure, stroke, and endocrine illness.
- Individuals with acute illness like fever.
- Immunocompromised individuals

Sample collection
Informed consent was obtained from the patient before sample collection. 5 ml of venous blood was collected. 3 ml was distributed in plain collection tubes and centrifuged at 3000 rpm for serum.

Table 1: FBS, HbA1c, and CRP levels in male and female of two groups

Parameters	Male		p value	Female		p value
	Control	DM		Control	DM	
FBS	89.23±9.31	168.53±35.03	0.000	80.58±5.08	146.58±32.8	0.000
HbA1C	4.18±0.62	7.78±0.97	0.000	4.36±0.68	6.94±0.59	0.000
CRP	6.39±1.01	28.85±17.7	0.011	6.64±0.64	25.47±21.09	0.001

FBS: Fasting blood sugar, HbA1C: Glycated hemoglobin, CRP: C-reactive protein

Table 2: Mean FBS, HbA1c, and CRP levels in two groups

Parameters	Control	DM	p value
FBS	85.08±8.47	158±35.12	0.000
HbA1C	4.27±0.63	7.38±0.90	0.000
CRP	6.51±0.83	27.23±19.06	0.000

FBS: Fasting blood sugar, HbA1C: Glycated hemoglobin, CRP: C-reactive protein
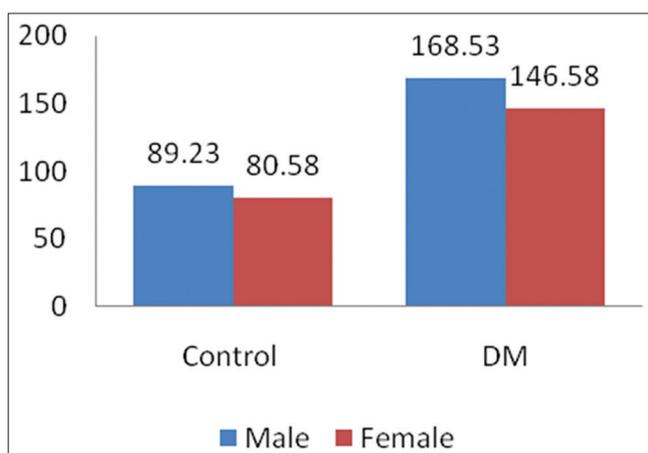
Fig. 1: Mean fasting blood sugar levels in male and female of two groups
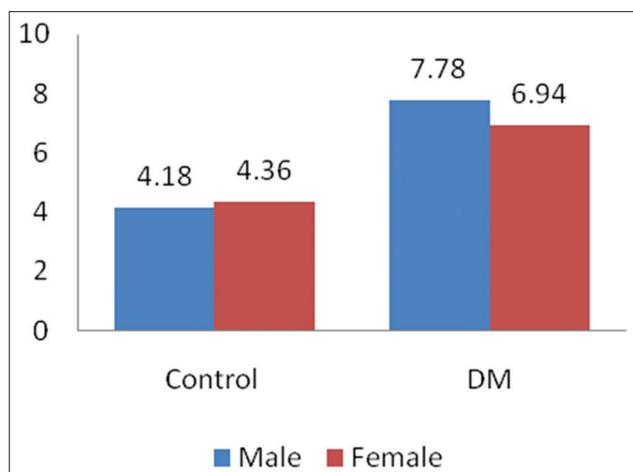
Fig. 2: Mean glycated hemoglobin levels in male and female of two groups

Then, serum was separated and analyzed to estimate the fasting blood sugar (FBS) by Trinder's method and CRP by Turbilatex method using ERBA CHEM 5 semi-auto analyzer. Then, 2 ml of blood was distributed in EDTA collection tubes and estimated glycated hemoglobin (HbA1c) by particle enhanced immunoturbidimetric method.

RESULTS

All the data were analyzed using SPSS package. Paired sample *t*-test analysis was done to find out significant differences between the two groups. All the tests were considered significant at p<0.05 level.

DISCUSSION

The results of this study revealed that there is a significant difference in mean FBS, HbA1c, and CRP levels of the normal individual group and T2DM individual group.

Mean serum FBS level in male and female of the T2DM group is 168.53±35.03 and 146.58±32.8 mg/dl, respectively (Table 1 and Fig. 1). Mean blood HbA1c level in male and female of the T2DM group is 7.78±0.97 and 6.94±0.59, respectively (Table 1 and Fig. 2). Mean serum CRP level in male and female of the T2DM group is 28.85±17.7 and 25.45±21.09 mg/L, respectively (Table 1 and Fig. 3). All three parameters were high in males when compared to the females in T2DM individual group.

Mean serum FBS level in male and female of the control group is 89.23±9.31and 80.58±5.08 mg/dl, respectively (Table 1 and Fig. 1). Mean blood HbA1c level in male and female of the control group is 4.18±0.62 and 4.36±0.68, respectively (Table 1 and Fig. 2). Mean serum CRP level in male and female of the control group is 6.39±1.01 and 6.64±0.64 mg/L, respectively (Table 1 and Fig. 3).

The serum FBS, HbA1c, and CRP levels in the control group and T2DM group were 85.08±8.47, 4.27±0.63, and 6.51±0.83 and 168, 7.38±0.9, and 27.23±19.06, respectively (Table 2 and Fig. 4). There was a significant (p=0.000) difference in the mean CRP levels of the above groups.

Our results provide evidence for a positive association between CRP levels and T2DM individuals. T2DM is characterized by insulin insensitivity as a result of insulin resistance, reduced insulin production, and beta cell failure. This leads to decreased glucose transport into the liver, muscle cells, and fat cells. There is an increase in the breakdown of fat with hyperglycemia [15,16]. Hyperglycemia is the key feature of diabetes. This increased blood glucose level stimulates the release of inflammatory cytokines tumor necrosis factor-α, interleukin-6 from adipocytes, which in turn stimulate CRP production in hepatocytes and induce a chronic inflammatory state [17,18].

CRP enhances the generation of free radicals by activating the complement platelet-activating factors and cytokines which stimulate leukocytes and release oxygen radicals or CRP directly stimulates monocytes and neutrophils and generates oxygen free radicals [19]. CRP and oxygen free radicals induce the expression of adhesion molecules in endothelial cells. These molecules are involved in atherogenesis [20]. Many studies show that CRP itself plays a role in pathogenesis of T2DM and atherosclerosis [21,22].

Hence, by estimating the CRP level, we can evaluate the inflammatory status of the diabetic individual, which helps to assess the progression of the disease condition.
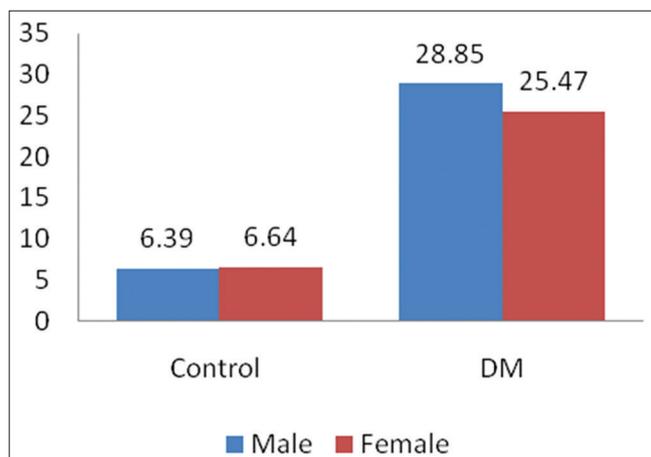
Fig. 3: Mean C-reactive protein levels in male and female of two groups
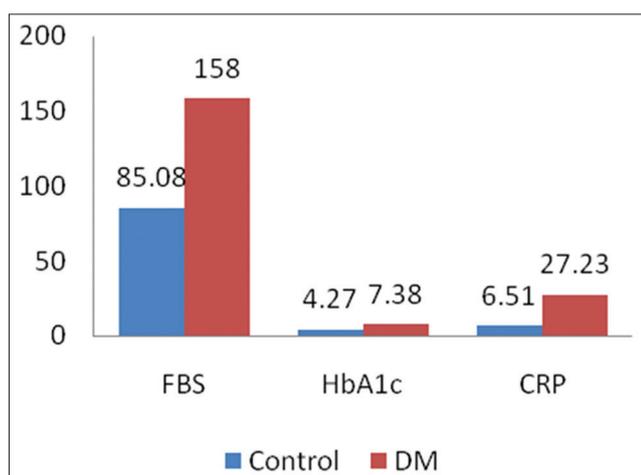
Fig. 4: Mean fasting blood sugar, glycated hemoglobin, and C-reactive protein levels in two groups

CONCLUSION

The present study CRP level was consistently higher in T2DM individuals; hence, it could be a simple and reliable marker to assess the inflammatory status of the diabetic individuals. Our data suggest that the measure of CRP might provide a simple method for the early detection of T2DM and its complications.

AUTHOR'S CONTRIBUTIONS

Concept and study design were done by Dr. G. Savitha and Dr. V. Vishnupriya. Data acquisition was done by Miss.S. Priyadharshini. Data interpretation, statistical analysis, manuscript drafting, and review were done by all three authors. All authors took part in the conduction of the study.

CONFLICTS OF INTEREST

The authors of this article declare no conflicts of interest in this study.

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