

## ORIGINAL RESEARCH

### Association of high-sensitivity C-reactive protein, Malondialdehyde with glycated hemoglobin in type II diabetes patients

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#### ABSTRACT

**Background:** Diabetes mellitus (DM) has become a major and serious threat to global human health. The present study assessed high-sensitivity C-reactive protein, malondialdehyde and their association with glycated hemoglobin in type II diabetes patients.

**Materials & Methods:** Group I comprised of 96 type II diabetics and group II had 96 healthy control subjects. HbA1c, serum insulin, hs-CRP, Homeostasis model assessment for insulin resistance, serum creatinine and malondialdehyde (MDA) levels were measured.

**Results:** Group I had 56 males and 40 females and group II had 48 males and 48 females. HOMA-IR was 4.8 in group I and 1.7 in group II, MDA level in group I was 5.07  $\mu\text{mol/L}$  and in group II was 1.31  $\mu\text{mol/L}$ . Creatinine level was 0.98 mg/L in group I and 0.85 mg/L in group II, cystatin C was 0.85 mg/L in group I and 0.92 mg/L in group II. The mean Hs-CRP (mg/L) level was 4.6 in group I and 1.9 in group II. The difference was significant ( $P < 0.05$ ).

**Conclusion:** Type II diabetes mellitus patients had elevated level of malondialdehyde and high-sensitivity C-reactive protein as compared to healthy control subjects.

**Key words:** glycated hemoglobin, malondialdehyde, diabetes mellitus

#### INTRODUCTION

Diabetes mellitus (DM) has become a major and serious threat to global human health. In the population aged 20 to 79 years, approximately 536.6 million people were diagnosed with DM worldwide in 2021, and this number will rapidly grow to 783.2 million in 2045 worldwide.<sup>1</sup> Type 2 DM (T2DM) has 90% proportion of DM, which is featured by insulin resistance and relatively insufficient insulin secretion.<sup>2</sup>

Hemoglobin A1c (HbA1c) can be measured in blood samples from patients regardless of their fasting or non-fasting state. Thus, it can be used as an indicator for diabetes rather than measuring blood sugar levels before meals or 2 hours after meals.<sup>3</sup> The American Diabetes Association has added  $\text{HbA1c} \geq 6.5\%$  as a diagnostic criterion for diabetes. Malondialdehyde (MDA) is a major player in low-density lipoprotein modification and is a product of the peroxidation of arachidonic, eicosapentaenoic and docosahexaenoic acids. Oxidised-LDL (ox-LDL) results from the interactions between aldehydes such as MDA and lysine residues

in apoB-100 of LDL.<sup>4</sup> Hs C-reactive protein is an acute phase reactant protein produced by liver response to several cytokines and sensitive marker of low- grade systemic inflammation. Studies reported that hs - CRP directly binds to oxidized low-density lipoprotein cholesterol (LDLC), induces plasminogen activator inhibitor-1 expression.<sup>5,6</sup> The present study assessed high-sensitivity c-reactive protein, malondialdehyde and their association with glycated hemoglobin in type II diabetes patients.

## MATERIALS & METHODS

The present study comprised of 96 diabetic patients of both genders. All were informed regarding the study and their written consent was obtained.

Data such as name, age, gender etc. was recorded. Patients were divided into 2 groups. Group I comprised of type II diabetics and group II had healthy control subjects. 5 ml of venous blood was obtained. HbA1c was estimated by ion exchange resin method, serum insulin was estimated by enzyme linked immunosorbent assay (ELISA), hs- CRP was assessed by latex turbidimetric immunoassay. Homeostasis model assessment for insulin resistance (HOMA-IR) HOMA- IR calculated by using fasting glucose and insulin values:  $HOMA - IR = \text{fasting insulin} \times \text{fasting glucose (m M/L)} / 22.5$ . The level of lipid peroxidation was determined by examination of malondialdehyde (MDA). Serum creatinine levels were measured by automatic picric colorimetry. The results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

## RESULTS

**Table I Distribution of patients**

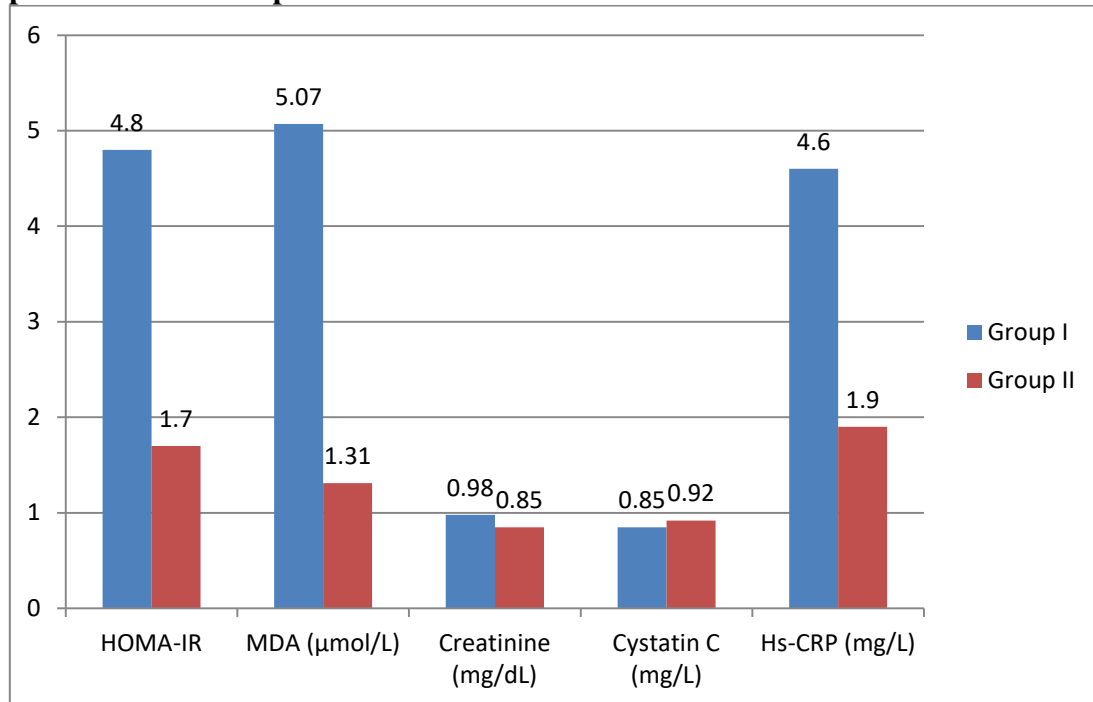
Groups	Group I	Group II
Status	Type II diabetes	Control
M:F	56:40	48:48

Table I shows that group I had 56 males and 40 females and group II had 48 males and 48 females.

**Table II Assessment of parameters**

Parameters	Group I	Group II	P value
HOMA-IR	4.8	1.7	0.01
MDA ( $\mu\text{mol/L}$ )	5.07	1.31	0.02
Creatinine (mg/dL)	0.98	0.85	0.05
Cystatin C (mg/L)	0.85	0.92	0.95
Hs-CRP (mg/L)	4.6	1.9	0.01

Table II, graph I shows that HOMA- IR was 4.8 in group I and 1.7 in group II, MDA level in group I was 5.07  $\mu\text{mol/L}$  and in group II was 1.31  $\mu\text{mol/L}$ . Creatinine level was 0.98 mg/L in group I and 0.85 mg/L in group II, cystatin C was 0.85 mg/L in group I and 0.92 mg/L in group II. The mean Hs-CRP (mg/L) level was 4.6 in group I and 1.9 in group II. The difference was significant ( $P < 0.05$ ).

**Graph I Assessment of parameters**

## DISCUSSION

Type 2 diabetes mellitus is a major public health problem worldwide and accompanied by enduring vascular complications, which leads to morbidity and mortality. Inflammation plays a pivotal role in the development of type II diabetes and vascular complications.<sup>7</sup> Impaired insulin secretion and sensitivity leads to oxidative stress, endoplasmic reticulum stress, amyloid deposition in the pancreas, lipotoxicity and glucotoxicity.<sup>8,9</sup> Studies reported that insulin resistance, inflammatory biomarkers, metabolic syndrome, dyslipidaemia, hypertension are predictive markers of cardiovascular disease (CVD) in type 2 diabetes mellitus.<sup>10,11</sup> The present study assess high-sensitivity c-reactive protein, malondialdehyde and their association with glycated hemoglobin in type II diabetes patients.

We found that group I had 56 males and 40 females and group II had 48 males and 48 females. Tang et al<sup>12</sup> recruited 927 patients. The median age of the recruited patients was 55 years, and there were 346 female patients and 581 male patients. The hs-CRP levels were evidently higher in patients with DKD than those without DKD. After adjusting for age, sex, diastolic blood pressure, systolic blood pressure, body mass index, neck circumference, waist circumference, hypertension, duration of diabetes, common carotid artery plaque, fasting plasma glucose, glycated hemoglobin, hemoglobin, erythrocyte, leukocyte,  $\gamma$ -glutamyl transferase, albumin, urea nitrogen, uric acid and triglyceride, a significant increase in the odds ratios for DKD in the fourth hs-CRP quartile compared with the first quartile was observed and the ORs in the fourth quartile of hs-CRP were 1.968 for DKD compared to the first quartile. Moreover, the RCS curves presented a positive association between hs-CRP and DKD in total subjects, male subjects and female subjects, respectively.

We found that HOMA- IR was 4.8 in group I and 1.7 in group II, MDA level in group I was 5.07  $\mu\text{mol/L}$  and in group II was 1.31  $\mu\text{mol/L}$ . Creatinine level was 0.98 mg/L in group I and 0.85 mg/L in group II, cystatin C was 0.85 mg/L in group I and 0.92 mg/L in group II. The mean Hs-CRP (mg/L) level was 4.6 in group I and 1.9 in group II. Lee et al<sup>13</sup> staged the level of diabetic nephropathy and estimated GFR based on serum creatinine and cystatin C (CysC).

Serum creatinine and CysC levels were 0.91 mg/dL and 0.87 mg/L, respectively. Correlation coefficients between CysC-GFR and each of the creatinine-based GFR measurements were 0.589, 0.569, and 0.479. Serum CysC was significantly lower in normoalbuminurics than in micro-albuminurics and macro-albuminurics and 1.05). Of the estimations of GFR, significant differences among the groups were found on CysC-GFR and CLcr. CysC-GFR (mL/min) was statistically lower in macroalbuminuric than in normoalbuminurics. The logistic regression analyses showed that retinopathy, A1C, CysC, diabetic duration, and CysC-GFR were indicators to predict the development of microalbuminuria. Serum CysC seems to be more accurate serum marker than serum creatinine in evaluating a prognostic stage of type 2 diabetic nephropathy.

Agrawal et al<sup>14</sup> assessed the total antioxidant status in relation to oxidative stress in type II diabetes mellitus. The fasting plasma glucose values in diabetic subjects were  $172.43 \pm 43.02$  mg/dl and  $89.52 \pm 10.21$  mg/dl in healthy controls. The post prandial plasma glucose values was  $247.26 \pm 46.16$  mg/dl in diabetic subjects and  $115.34 \pm 42.18$  mg/dl in controls. There is significant increase in MDA levels among diabetic patients  $4.01 \pm 0.78 \mu\text{M}$  in comparison to the controls ( $1.99 \pm 1.22 \mu\text{M}$ ).

The limitation of the study is small sample size.

## CONCLUSION

Authors found that type II diabetes mellitus patients had elevated level of malondialdehyde and high-sensitivity C-reactive protein as compared to healthy control subjects.

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