ASSESSING THE CORRELATION OF URINARY ALBUMIN TO CREATININE RATIO, C-REACTIVE PROTEIN, AND LIPID PROFILE IN DIABETIC SUBJECTS

Amit Ranjan¹, VivekAnand Ojha², Santosh Kumar³, Prakash Chandra Mishra⁴*

¹Senior Resident, Department of Biochemistry, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand, India
²Senior Resident, Department of Biochemistry, ESIC Medical College and Hospital, Bihta, Patna, Bihar, India
³Professor, Department of Biochemistry, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand, India
⁴Senior Resident, Department of Biochemistry, ESIC Medical College and Hospital, Bihta, Patna, Bihar, India

Address for Correspondence
Dr. Prakash Chandra Mishra
Senior Resident, Department of Biochemistry, ESIC Medical College and Hospital, Bihta, Patna, Bihar, India
Email id: vao1227@gmail.com

ABSTRACT
Background: The present study was conducted to assess the correlation of urinary albumin-to-creatinine ratio (ACR), high-sensitive C-reactive protein, and lipid profile in diabetic subjects.

Methodology: The present study included 120 diabetic subjects divided into three groups of 40 subjects each where the group I included diabetics having a diagnosis of diabetes for less than 5 years, group II included diabetics diagnosed with diabetes between 5-10 years, and group III subjects having diabetes diagnosed for more than 10 years. For these subjects, albumin-to-creatinine ratio (ACR), high-sensitive C-reactive protein, and lipid profiles were assessed.

Results: A correlation was seen between triglycerides, albumin-to-creatinine ratio, and high-sensitive C-reactive protein in group I subjects. In group II, a significant correlation was seen between the albumin-to-creatinine ratio and high-sensitive C-reactive protein. A significant correlation was seen in LDL, cholesterol, and albumin-to-creatinine ratio.

Conclusion: The present study concludes that ACR and levels of high-sensitive C-reactive protein are higher in subjects having diabetes for a longer duration.

Keywords: Albumin-to-creatinine ratio, C-reactive protein, diabetes, diabetes duration, lipid profile.

INTRODUCTION

A systemic disorder causing hyperglycemia in affected subjects owing to insulin resistance, defective insulin secretion, or both are termed Diabetes. Diabetes is a systemic disorder affecting almost all the organs in the human body. Diabetes has high mortality and morbidity rates in the developed as well as in developing countries like Bhutan, Nepal, Indonesia, and India. Despite high advancements in the technologies and medical sector, diabetes remains
incurable with no permanent treatment modality available for curing diabetes permanently.\textsuperscript{1} Hence, an effective treatment to control hyperglycemia status is vital to prevent complications associated with diabetes. The effect of diabetes on the urinary system, central nervous system, cardiovascular system, retina, and renal system should be carefully monitored as subjects having diabetes have a high incidence of renal disease and renal failure compared to their non-diabetic counterparts.\textsuperscript{2}

Diabetes is also linked to low levels of albumin in the blood of affected individuals seen within the range of 30mg/day to 300mg/day. These decreased albumin levels in the blood are suggestive of early nephropathy signs. Nephropathy is one of the complications seen in subjects with diabetes mellitus. As per the guidelines of the American Diabetes Association, confirmatory diagnosis of albuminuria can only be made after assessing the collected 24-hours sample of the affected individual. This method is considered as gold-standard for the diagnosis of microalbuminuria.\textsuperscript{3}

Following the recommendations of the National Kidney Foundation, a more effective, efficient, and reliable method to assess microalbuminuria is an albumin-to-creatinine ratio which is advised in all the subjects with diabetes mellitus. Also, classification of chronic kidney disease suggests assessing the albumin-to-creatinine for confirmatory diagnosis of renal diseases.\textsuperscript{4}

C-reactive protein (CRP) is one of the most reliable for confirmatory diagnosis of the inflammatory disease present in the human body. CRP levels are seen elevated in various traumas, inflammatory, and infective conditions. Hence, high-sensitive C-reactive protein (hs- CRP) is a very potent agent to assess inflammation. An increase in CRP levels is also seen elevated concerning the albumin-to-creatinine ratio.\textsuperscript{5} The present study was conducted to assess the correlation of urinary albumin-to-creatinine ratio (ACR), high-sensitive C-reactive protein, and lipid profile in diabetic subjects.

**MATERIALS AND METHODS**

The present comparative clinical study was conducted to assess the correlation of urinary albumin-to-creatinine ratio (ACR), high-sensitive C-reactive protein, and lipid profile in diabetic subjects. The study was carried out at Rajendra Institute of Medical Sciences, Ranchi, Jharkhand, India from December 2020 to October 2021. The study population was comprised of the subjects visiting the Outpatient Department of the Institute. The study included a total of 120 diabetic subjects from both genders. After explaining the detailed study design, informed consent was taken from all the study subjects.

The inclusion criteria for the study were subjects with a confirmed diagnosis of diabetes, within the age range of 20-65 years, and the subjects who were ready to give consent. The exclusion criteria were subjects who were pregnant, on long-term use of thiazides, beta-lactamase, cyclosporine, endocrinopathies, renal disease history, or cardiac disease history. After the final inclusion of the subjects based on the inclusion and exclusion criteria, detailed history was recorded followed by a general and systemic examination. After this the subjects
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were divided into 3 groups of 40 subjects each where the group I included diabetics having a diagnosis of diabetes for less than 5 years, group II included diabetics diagnosed with diabetes between 5-10 years, and group III subjects having diabetes diagnosed for more than 10 years.

For each included study subject, HbA1c levels (Glycosylated hemoglobin), random blood glucose, and fasting blood glucose levels were estimated by collecting 5ml intravenous blood from peripheral veins. Also, lipid profile was estimated including triglycerides (TG), high-density lipoprotein (HDL), low-density lipoproteins (LDL), and total cholesterol levels were assessed for all study subjects. Urine albumin and creatinine levels were assessed using analyzers after collecting urine samples. High-sensitive CRP levels were also assessed for the study subjects.

The collected data were subjected to the statistical evaluation using SPSS software version 21 (Chicago, IL, USA) and one-way ANOVA and t-test for results formulation. The data were expressed in percentage and number, and mean and standard deviation. The level of significance was kept at p<0.05.

RESULTS

The present comparative clinical study was conducted to assess the correlation of urinary albumin-to-creatinine ratio (ACR), high-sensitive C-reactive protein, and lipid profile in diabetic subjects. The study included a total of 120 diabetic subjects from both genders within the age range of 20-65 years. The demographic characteristics of the study subjects are described in Table 1. The mean age of the study subjects in Group I, Group II, and Group III was 42.2±2.46, 43.1±1.88, and 44.3±3.62 years respectively. The age range of subjects from group I was 20-62 years, group II subjects were 21-65 years, and group III subjects were 22-63 years respectively. In group I, there was 25 males and 15 females, in group II, there were 17 males and 23 females, and in group III, there were 19 males and 21 females as depicted in Table 1.

On assessing the study parameters in the three groups of the study subjects, it was seen that HDL was 48.4±4.7, 49.3±4.8, and 50.3±4.7 mg/dl in the group I, II, and III subjects respectively, whereas, LDL was 132.3±30.2, 140.4±31.8, and 145.4±37.7 mg/dl respectively for group I, II, and III subjects with highest in group III (p=0.02). The cholesterol levels for Group I, II, and III subjects respectively were 210.7±37.4, 225.6±30.6, and 232.3±27.3 mg/dl respectively which was highest for group III with statistically significant difference (p=0.03). Total triglycerides levels were 221.2±25.6 and 250.4±26.4 for groups I and II respectively. The highest value was for group III with 261.1±27.6 mg/dl. This difference was also statistically significant with p=0.01 (Table 2).

The ACR (Albumin creatinine ratio) was also highest in group III subjects having the highest duration of diabetes with the value of 129.3±12.3 which was statistically significant with p=0.05 followed by Group II subjects having the ratio of 116.2±15.6 and least for group I have the value of 102.6±13.4. Similarly, the hs CRP value was highest for group III diabetics having the value of 0.12±0.16 followed by group II having the value of 0.06±0.08 and the
least value of hsCRP was seen for group I subjects having diabetes for the least duration with a value of 0.03±0.01. This was also statistically significant with p=0.01 as shown in Table 2

DISCUSSION

The present comparative clinical study was conducted to assess the correlation of urinary albumin-to-creatinine ratio (ACR), high-sensitive C-reactive protein, and lipid profile in diabetic subjects. The study included a total of 120 diabetic subjects from both genders within the age range of 20-65 years. The demographic characteristics of the study subjects are described in Table 1. The mean age of the study subjects in Group I, Group II, and Group III was 42.2±2.46, 43.1±1.88, and 44.3±3.62 years respectively. The age range of subjects from group I was 20-62 years, group II subjects were 21-65 years, and group III subjects were 22-63 years respectively. In group I, there was 25 males and 15 females, in group II, there were 17 males and 23 females, and in group III, there were 19 males and 21 females. These findings were comparable to the studies of Patil A et al6 in 2014 and Acharjya D et al7 in 2019 where authors assessed comparable demographics as in the present study.

On assessing the study parameters in the three groups of the study subjects, it was seen that HDL was 48.4±4.7, 49.3±4.8, and 50.3±4.7 mg/dl in the group I, II, and III subjects respectively, whereas, LDL was 132.3±30.2, 140.4±31.8, and 145.4±37.7 mg/dl respectively for group I, II, and III subjects with highest in group III (p=0.02). The cholesterol levels for Group I, II, and III subjects respectively were 210.7±37.4, 225.6±30.6, and 232.3±27.3 mg/dl respectively which was highest for group III with statistically significant difference (p=0.03). Total triglycerides levels were 221.2±25.6 and 250.4±26.4 for groups I and II respectively. The highest value was for group III with 261.1±27.6mg/dl. This difference was also statistically significant with p=0.01. These results were consistent with the results of Kamath DY et al8 in 2015 and Khan MI et al9 in 2012 where comparable lipid profiles as in the present study were shown by the authors in their respective studies. The ACR (Albumin creatinine ratio) was also highest in group III subjects having the highest duration of diabetes with the value of 129.3±12.3 which was statistically significant with p=0.05 followed by Group II subjects having the ratio of 116.2±15.6 and least for group I have the value of 102.6±13.4. Similarly, the hs CRP value was highest for group III diabetics having the value of 0.12±0.16 followed by group II having the value of 0.06±0.08 and the least value of hsCRP was seen for group I subjects having diabetes for the least duration with a value of 0.03±0.01. This was also statistically significant with p=0.01. These findings were in agreement with the studies of Shin Di et al10 in 2013 and Varghese A et al11 in 2001 where similar Albumin creatinine ratio and high-sensitive CRP were seen in the diabetic population of their studies.

CONCLUSION

Within its limitations, the present study concludes that there exists a correlation between lipid profile, albumin-to-creatinine ratio, and high-sensitive C-reactive protein in the diabetic subjects with the higher values in the subjects having the longest duration of diabetes. However, the present study had a few limitations including small sample size, cross-section nature, and geographical area biases. Hence, more longitudinal studies with larger sample size and longer monitoring period will help reach a definitive conclusion.
REFERENCES

TABLES

<table>
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<tr>
<th>Characteristics</th>
<th>Group I</th>
<th>Group II</th>
<th>Group III</th>
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<tr>
<td>Mean Age (years)</td>
<td>42.2±2.46</td>
<td>43.1±1.88</td>
<td>44.3±3.62</td>
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<tr>
<td>Age Range (years)</td>
<td>20-62</td>
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<td>Males</td>
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<tr>
<td>Females</td>
<td>15</td>
<td>23</td>
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Table 1: Demographic characteristics of the study subjects

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Group I</th>
<th>Group II</th>
<th>Group III</th>
<th>p-value</th>
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<tr>
<td>HDL</td>
<td>48.4±4.7</td>
<td>49.3±4.8</td>
<td>50.3±4.7</td>
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</tr>
<tr>
<td>LDL</td>
<td>132.3±30.2</td>
<td>140.4±31.8</td>
<td>145.4±37.7</td>
<td>0.02</td>
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<tr>
<td>Cholesterol</td>
<td>210.7±37.4</td>
<td>225.6±30.6</td>
<td>232.3±27.3</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>Group 1</td>
<td>Group 2</td>
<td>Group 3</td>
<td>p-value</td>
</tr>
<tr>
<td>------------------------</td>
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</tr>
<tr>
<td><strong>Triglycerides</strong></td>
<td>221.2±25.6</td>
<td>250.4±26.4</td>
<td>261.1±27.6</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>Albumin creatinine</strong></td>
<td>102.6±13.4</td>
<td>116.2±15.6</td>
<td>129.3±12.3</td>
<td>0.05</td>
</tr>
<tr>
<td><strong>ratio</strong></td>
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<tr>
<td><strong>High-sensitive CRP</strong></td>
<td>0.03±0.01</td>
<td>0.06±0.08</td>
<td>0.12±0.16</td>
<td>0.01</td>
</tr>
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Table 2: Assessment of study parameters in three groups of the study subjects