Significance of Serum Ferritin and Vitamin-D Level in Coronary Artery Disease Patients

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Coronary artery disease is one of the most common noncommunicable diseases that affects both men and women worldwide. Chronic inflammation and mineral nutrient deficiency, in addition to diet and sedentary lifestyle, contribute to this disease. The purpose of this study is to look at the relationship between serum ferritin, serum vitamin D levels, and serum lipid profile in patients with Coronary Artery Disease. The research was carried out at the Mahatma Gandhi Medical College and Research Institute in Puducherry. A standardised health questionnaire was distributed to study participants, which included 30 patients with Coronary Artery Disease (cases) and 30 healthy controls. It detailed current and previous medication use, hypertension, and coronary artery disease. Subjects were chosen based on their responses to study-related questions. For both cases and controls, means and standard deviations (SD) were computed. To determine the relationship between the parameters, ANOVA and Pearson’s correlation were used, and it was used to find the statistical significance and correlation of Serum Ferritin, Serum Vitamin D, and Serum Lipid Profile among both groups. The serum ferritin levels among cases (208.87 ± 143.01 µg/lit) were found to be high when compared to controls (99.52 ± 61.19 µg/lit) with a significant p value of 0.0003. The Serum vitamin D value of cases (21.14 ± 12.9 ng/dl) was low when compared to controls (56.54 ± 18.88 ng/dl) with a significant p value of 0.0000. Serum LDL of cases (129.1 ± 26.91 mg/dl) were found to be higher than controls (105.1 ± 25.43 mg/dl). HDL of cases (33.83 ± 6.82 mg/dl) was found to be lower than controls (49.53 ± 6.12 mg/dl). Altered lipid profile with low HDL-C, high LDL-C, and high LDL-C/HDL-C suggested an increased risk for CAD. Low vitamin D levels were also associated with a higher risk for CAD. According to this study, CAD patients had high serum ferritin levels, low serum vitamin D levels, and an altered lipid profile status.

Keywords: Coronary Artery Disease (CAD); Ferritin; HDL; LDL; Vitamin D.
caused by coronary atherosclerosis may cause transient disturbances in myocardium mechanical, biochemical, and electrical functions. Various studies in India have revealed a high prevalence of CAD, approaching 11% in the urban population and 7% in the rural population. Non-modifiable risk factors for CAD include age, gender, and family history, while modifiable risk factors include diabetes mellitus (DM), smoking, dyslipidemia, hypertension, and obesity.

Iron is required for many physiological processes, and iron overload has been linked to the progression of atherosclerosis. Excess iron can stimulate the progression of atherosclerotic lesions by catalysing the production of free radicals and promoting lipid peroxidation by lowering antioxidant levels in plasma; thus, it can be associated with the progression of atherosclerosis and increase the risk of ischemic cardiovascular events. Serum ferritin is a 440 KD macromolecular protein, one-third of which is formed by iron. Serum ferritin levels are the most accurate way of measuring body iron stores. Total iron intake and serum iron concentrations were found to be inversely related to CHD incidence. Previous research indicates that vitamin D deficiency is linked to myocardial infarction, heart failure, diabetic cardiovascular disease, and peripheral vascular disease. Furthermore, recent research has found an inverse relationship between mean serum Vitamin D levels and blood pressure, diabetes, carotid atherosclerosis, microalbuminuria, stroke, and decreased renal function. Recent research suggests a link between vitamin D levels and cardiovascular disease, hypertenion, heart failure, and fatal stroke. Several mechanisms could account for the link between vitamin D levels and cardiovascular disease. Vitamin D deficiency causes changes in the smooth muscle of the vascular wall, as well as inflammation and thrombosis, which could explain cardiovascular complications. By a mechanism other than macrophage foam-cell formation, oxidised LDL may contribute to atherogenesis and its sequelae. As a result, this study was carried out to determine whether there is a significant relationship between vitamin D and serum ferritin in coronary artery disease patients from the Puducherry population.

**Aim**

To investigate the significance of serum ferritin and serum vitamin D levels in patients with coronary artery disease.

**MATERIALS AND METHODS**

This analytical case-control study was conducted at the Mahatma Gandhi Medical College and Research Institute, Puducherry [MGMCRI], a tertiary health care institution under the jurisdiction of Sri Balaji Vidyapeeth University Puducherry, in collaboration with the Departments of General Medicine and Cardiology. Both the Institutional Research Committee and the Institutional Human Ethical Committee approved the project. A standardised health questionnaire was distributed to study participants, which included 30 Coronary Artery Disease patients (cases) and 30 healthy controls. It contained information on current and previous medication use, hypertension, and coronary artery disease. Subjects were chosen based on their responses to study-related questions.

**Inclusion criteria**

Patients with newly diagnosed coronary artery disease in the General Medicine and Cardiology Outpatient Departments at Mahatma Gandhi Medical College and Research Institute. Healthy volunteers who were employed in MGMC&RI [for controls]

**Exclusion criteria**

1. Patients who had Tuberculosis, Type-1 diabetes mellitus, Anemia, Chronic bone pain, Renal failure, and Endocrine disorders
2. Pregnant women
3. Patients who are already on calcium, vitamin-D, multivitamin, haematinics, steroid, and hormonal treatment

**Sample collection**

Under aseptic precautions, venous blood (5ml) was drawn from all the subjects after overnight fasting of 10-12hours. Serum was separated for analysis of serum Ferritin and serum vitamin-D levels

**Study parameters**

1. Serum Ferritin
2. Serum Iron
3. Hemoglobin % in whole blood  
4. Serum Vitamin-D  
5. Serum cholesterol  
6. Serum Triglycerides  
7. High density lipoprotein (HDL)  
8. Low density Lipoprotein (LDL)  

**Statistical analysis**

The mean and standard deviation (SD) of cases and controls were computed. The statistical analysis was carried out using the Statistical Package for the Social Sciences (SPSS) version 17 software. To determine the relationship between the parameters, ANOVA and Pearson’s correlation were used, and it was used to find the statistical significance and correlation of serum ferritin and Vitamin D among the groups. P d” 0.05 was considered significant.

**RESULTS**

This study included 30 control and 30 Coronary artery disease [CAD] patients after appropriate screening. Table 1 shows the mean and standard deviation of biochemical parameters of controls and cases, as well as the age and gender distribution among 30 controls and 30 coronary artery disease [CAD] patients.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Case</th>
<th>Control</th>
<th>t-test</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ferritin µg/lit</td>
<td>208.87±143.01</td>
<td>99.52 ± 61.19</td>
<td>3.8504</td>
<td>0.0003</td>
</tr>
<tr>
<td>Iron µg /dl</td>
<td>153.47 ± 52</td>
<td>110.57 ± 23.22</td>
<td>4.1260</td>
<td>0.0001</td>
</tr>
<tr>
<td>Hb%</td>
<td>16.36 ± 1.69</td>
<td>14.77 ± 1.1</td>
<td>4.3076</td>
<td>0.0001</td>
</tr>
<tr>
<td>Vitamin D ng/dl</td>
<td>21.14 ± 12.9</td>
<td>56.54 ± 18.88</td>
<td>8.4776</td>
<td>0.0000</td>
</tr>
<tr>
<td>Cholesterol mg/dl</td>
<td>193.33 ± 59.2</td>
<td>154.53 ± 27.07</td>
<td>3.2645</td>
<td>0.0018</td>
</tr>
<tr>
<td>TAG mg/dl</td>
<td>126.73±44.89</td>
<td>99.77 ± 26.23</td>
<td>2.8410</td>
<td>0.0062</td>
</tr>
<tr>
<td>HDL mg/dl</td>
<td>33.83±6.82</td>
<td>49.53±6.12</td>
<td>0.717</td>
<td>0.479</td>
</tr>
<tr>
<td>LDL mg/dl</td>
<td>129.1 ± 26.91</td>
<td>105.1 ± 25.43</td>
<td>3.5508</td>
<td>0.0008</td>
</tr>
</tbody>
</table>

**Table 2. Correlation Between Vitamin D and Serum ferritin**

<table>
<thead>
<tr>
<th>Correlation</th>
<th>Pearson Correlation</th>
<th>Sig. (2-tailed)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin D &amp; Ferritin</td>
<td>-0.18755</td>
<td>0.151299</td>
<td>60</td>
</tr>
</tbody>
</table>

**DISCUSSION**

Because lipids are crucial in the pathogenesis of CAD, most research has focused on measuring lipid levels. Hyperlipidemia is now well recognised as one of the most important risk factors for CAD. Earlier research focused on individual lipids, but recent research in lipoprotein profile suggests that the association with serum lipids is not only coincidental, but that regression of an abnormal lipid profile may be therapeutic and prognostic.23,24

The current study attempted to investigate the relationship between serum ferritin levels and Vitamin D in CAD patients. The serum ferritin pattern in CAD patients and healthy controls was studied and the variations were compared. The mean total ferritin level of CAD patients (208.87±143.01) was significantly greater than that of controls (99.52±61.19) with p<0.0003. Iron has been proposed as an atherogenic agent primarily due to its ability to initiate severe oxidative stress, which is supported by epidemiologic and experimental research. Ferritin levels were higher in CAD patients than in controls, according to our findings. As a result, elevated ferritin levels may be an additional risk factor for atheromatic plaque formation and subsequent CAD development.25

The current study found a decrease in vitamin –D [21.14±12.9ng/dl] than the control group i.e., [56.54±18.88 ng/dl]. However, the drop in vitamin D concentration was statistically
significant. (P<0.0001) when compared to the control group. Previous epidemiological research has linked vitamin D deficiency to myocardial infarction, heart failure, diabetic cardiovascular disease, and peripheral vascular disease. Individuals with vitamin D deficiency who were followed for 4 to 5 years had a 53% to 80% higher rate of cardiovascular complications such as death from myocardial infarction or heart failure. Furthermore, recent research has linked the average serum level of Vitamin D to hypertension, diabetes, and atherosclerosis. Vitamin D has a longer half-life and can more precisely show food intake, skin production, and period of deficiency, with levels ranging from 20-30ng/ml as insufficient and higher than 30ng/ml as desirable. Vitamin D receptors are found in the majority of body cells, including cardiomyocytes, vascular smooth muscles, and vessel endothelium26. The risk of cardiovascular disease was nearly four times higher in vitamin D deficient individuals compared to those with a normal level of vitamin D. 27 Vitamin D levels fluctuate, causing changes in the smooth muscles of the vascular wall and inflammation, which could explain cardiovascular complications. 28. Vitamin D deficiency, possibly in conjunction with low calcium intake, has been linked to impaired fasting glucose and an increased risk of type 2 diabetes mellitus, both of which are risk factors for CAD.

CONCLUSION

To summarise, high ferritin levels in CAD patients may be an additional risk factor for atheromatous plaque formation and subsequent CAD development. Low vitamin D levels are also linked to an increased risk of CAD. Evidence suggests that maintaining normal serum ferritin and vitamin D levels in the body can help prevent CAD.

ACKNOWLEDGEMENT

We gratefully acknowledge the Departments of Biochemistry, General Medicine, and Cardiology at Mahatma Gandhi Medical College and Research Institute, Puducherry, for their assistance in completing this project.

Authors contribution

Mr. E. Vasudevan conducted this research under the supervision of Dr. B. Shanthi. The discussion was written by Dr. Mary Chandrika Anton, Dr. Chaganti Sridevi, and Dr. Sumathi. K, Miss Nivethini.

Ethical Standards

The study involved human participants following the ethical standards of the tertiary health care institution where the study was conducted.

Conflict of Interest

Declared none by the authors.

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The principle investigator did not get any funding from any agencies for carrying out this project.

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