Evaluation of Serum Ferritin in Type-2 Diabetes Mellitus

Sudanese Patients

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Abstract:

Background: Type 2 diabetes mellitus (DM2) is an important health problem worldwide affecting about 8 percent of the population. Diabetes Mellitus is one of the most common chronic diseases in Sudan. These patients have many changes in their blood, and many factors affect the glucose tolerance that is mediated by insulin, one of these changes is S.ferritin level, a marker of iron storage. Increased serum ferritin, reflecting body iron overload, is often associated with insulin resistance. The role of iron in the pathogenesis of diabetes is suggested by an increased incidence of type2 diabetes mellitus in diverse causes of iron overload, and reversal or improvement in glycemic control with a reduction in iron load achieved using either phlebotomy or iron-chelating therapy.

Aim: To evaluate serum ferritin level in type-2 Diabetes Mellitus Sudanese Patients.

Materials and Method: A case-control study was done in 45diabetic patients and 45 normal healthy individuals as a control group, including measurement of serum ferritin by an electrochemiluminescence immunoassay (ECLIA) method full automated chemical analyzer. COBAS e411 machine used Roche HITACHI Kit and quantification of HbA1c level by i-chroma instrument.

Results: The study showed that serum ferritin levels were significantly increased in diagnosed cases of type 2 diabetes mellitus in comparison with the age and gender-matched healthy individuals (P. value= 0.008). There was an insignificant correlation between serum ferritin and HbA1c(P. value=0.431).

Conclusion: Therefore, the findings of the present study indicate that serum ferritin was increased in diabetes and this increase may contribute to the pathogenesis of this disease as well as to the development of complications. Thus, routine screening for serum ferritin concentration in pre-diabetes and diabetic patients should be done to assess the body's iron stores.

Key Words: Diabetes Mellitus, Ferritin, Glycosylated hemoglobinA1c.

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Introduction:
Type 2 diabetes mellitus (DM2) is an important health problem worldwide affecting about 8 percent of the population. (Hughes et al., 2004). The prevalence of the disease continued to rise over the recent decades. (McKinlay et al., 2000),(Wild S et al.,2000),(Freid et al., 2003),(Yang et al., 2010),(Fox et al., 1970s-1990s). The probable role of inflammatory factors and cytokines in producing DM was described by Pickup JC in 1998. (Pickup et al .,1998). Similar results also were found in other studies which showed that acute phase reactants may be useful for predicting DM;(Thorand et al .,1984-1998),(Festa et al .,2001),(Freeman et al .,2002),(Hu FB et al .,2004), however, these findings were not found in some other studies. (Krakoff et al ., 2003).

Acute phase reactants are proteins that respond to acute stress such as infection, trauma, surgery, and tissue necrosis. Some of these agents are alpha-acid glycoprotein, haptoglobin, fibrinogen, C-reactive protein (CRP), and ferritin. (Gauldie et al .,1987),(Moshage et al ., 1987),(Kushner et al ., 1982). CRP is produced by liver cells and could activate the complement system and T and B lymphocytes. Erythrocyte Sediment Rate (ESR), as an acute-phase reactant, is less important than CRP for the evaluation of inflammation. (Festa et al ., 2001),(Hoffmann et al .,1999). Ferritin is a complex globular protein that stores iron as a soluble and non-toxic component. In oxidative stress, Fe2+ enters cells and then changes to Fe3+, linked to ferritin, and then protects cells from oxidative stress. (Theil et al .,1987). Increasing the concentration of iron and ferritin in cells could cause resistance to insulin and dysfunction of β cells of the pancreas. Hyperinsulinemia due to insulin resistance may be responsible for increasing serum ferritin. It has been suggested that disturbance of iron metabolism could cause insulin resistance, hyperinsulinemia, dyslipidemia, HTN, and central obesity. (Jehn et al ., 2004),(Ashourpour et al .,2010).

S.ferritin is an acute phase reactant and is a marker of the iron stored in the body. (Koorts et al .,2011). Increased ferritin may induce diabetes through a variety of mechanisms including oxidative damage to pancreatic beta cells, impairment of hepatic insulin extraction by the liver, and interference with insulin's ability to suppress hepatic glucose production. (Sumesh et al ., 2013).

Raised S.ferritin may be related to the occurrence of long-term complications of diabetes, both micro vascular and macro vascular. (Kim et al ., 2000),(Eshed et al ., 2001).

The significance of iron in the pathophysiology of diabetes is derived from the ease with which iron is reversibly oxidized and reduced as it plays a critical role in the production of reactive oxygen species.

Patients and method:
The study was done in Khartoum-Sudan- Zinam Center for diabetes and endocrinology. A forty-five (45) Sudanese patients with type2 diabetes mellitus were enrolled in this study against another forty-five (45) healthy donors to compare S.ferritin between the two groups.

Information was obtained from patients and control groups before collection. Any patient who has an autoimmune disease, infectious disease, consumption of steroid or immunosuppressive drugs was excluded. Venous blood (3 ml) was collected in a plain tube from each patient. the clotted blood sample was centrifuged, and the sera were transferred to new containers.

Laboratory investigations included measurement of serum ferritin level by COBAS E411 machine.

Statistical analysis:
Data were analyzed manually and by using computer software (SPSS) version 25 and the results were presented in graphs.

Statistical values less than 0.05 were considered significant, and above 0.05 were considered insignificant.

Results:
A total of 45 type2 of diabetic patient samples were collected in this study (21) were male, (and 24) were female. The mean age of patients was (18-60) years old.
The serum ferritin in type2 diabetic patients (mean 411.3± SD 82.5) and control (186.3± SD 6.65)(P = 0.008). The serum ferritin in

Table 1: shows a comparison between diabetic and normal cases regarding their ferritin levels

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Group</th>
<th>N</th>
<th>Mean±SD</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum ferritin (ng/ml)</td>
<td>Case</td>
<td>45</td>
<td>411.3±82.5</td>
<td>0.008</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>45</td>
<td>186.3±6.65</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: shows a comparison of the mean value of serum ferritin related to age among diabetic patients

<table>
<thead>
<tr>
<th>Age</th>
<th>N</th>
<th>Mean±SD</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-40 Years</td>
<td>3</td>
<td>772.3±160.2</td>
<td></td>
</tr>
<tr>
<td>40-60 Years</td>
<td>27</td>
<td>384.8±98.72</td>
<td>0.023</td>
</tr>
<tr>
<td>&gt;60 Years</td>
<td>15</td>
<td>386.8±131.2</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Showing the duration of diabetes mellitus in years and serum ferritin (ng/ml)

<table>
<thead>
<tr>
<th>Duration</th>
<th>N</th>
<th>Mean±SD</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5 Years</td>
<td>11</td>
<td>477.2±181.9</td>
<td></td>
</tr>
<tr>
<td>5-10 Years</td>
<td>17</td>
<td>477.6±178.6</td>
<td>0.124</td>
</tr>
<tr>
<td>&gt;10 Years</td>
<td>17</td>
<td>302.3±55.98</td>
<td></td>
</tr>
</tbody>
</table>

Table 4: Showing comparison of the mean value of serum ferritin related to gender among diabetic patients

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Gender</th>
<th>N</th>
<th>Mean±SD</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum ferritin (ng/ml)</td>
<td>Male</td>
<td>21</td>
<td>499.4±123.8</td>
<td>0.326</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>24</td>
<td>334.2±110.5</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1: Scatter diagram showing no correlation between serum ferritin and Glycated hemoglobin
Discussion:
Type 2 diabetes mellitus (DM2) is an important health problem worldwide affecting about 8 percent of the population. (Hughes E et al., 2006) Diabetes Mellitus is one of the most common chronic diseases in Sudan. (Bos M, Agyemang C, 2013). Those patients have many changes in their blood, and many factors affect the glucose tolerance that is mediated by insulin, one of these changes is S.ferritin level, a marker of iron storage. The results of this study showed that serum ferritin in diabetic patients is significantly higher than in non-diabetics, but its level has no correlation with HbA1c in diabetic patients. Ferritin has been known as an index for body iron stores and also as an inflammatory marker. There are different theories regarding the role of ferritin in diabetes mellitus. Oxidative damage to pancreatic beta cells, impairment of hepatic insulin extraction by the liver, and interference with insulin's ability to suppress hepatic glucose production. Pancreatic inflammation and some referred to it as a marker for insulin resistance.

The present study is reported from Sudan Khartoum state regarding the role of serum ferritin levels and their effect in patients with type2 diabetes mellitus. In this study the correlation between serum ferritin and normal control, but its level does not correlate with HbA1c. Such results have also been reported by F.Sharifi*and Sh.Sazandeh in Zanjan diabetes clinic, Iran.( F.sharifi et al., 2004).

Sumesh Raj, G.V.Rajanz, in their study reported that S.ferritin level is higher in type2 DM patients than in the control group and serum ferritin had a positive correlation with increasing duration of diabetes. There was a positive correlation between serum ferritin and HbA1c. There was no correlation between serum ferritin and age, or gender. (Raj et al., 2013).

The result in this study differs from the study done by Maheswari et al., serum ferritin was significantly higher and the correlation between serum ferritin and HbA1c was positive. (Maheshwari et al .,2015).

Another study was done by Meghna Borah, Rohini k. Goswami, in Indian populations. The study showed that serum ferritin levels significantly increased in diagnosed cases of type2 DM in comparison with the age and gender-matched healthy individuals. A strong positive correlation between serum ferritin and HbA1c.(Meghna et al .,2016).

The result in this study differs from other results due to varies greatly in different populations, sample sizes, and methods.

In summary, this study revealed that serum ferritin level was increased in type2 diabetic patients. However, further investigations are needed to confirm these results in other larger populations.

Conclusion:
A high level of serum ferritin is found in patients with type2 diabetes mellitus, thus, routine screening for serum ferritin concentration in pre-diabetes and diabetic patients must be done to assess the body's iron stores.

References:


