Assessment of serum zinc, copper and copper/zinc ratio in adult patients with psoriasis

Nazar Hamdan Jassem Al-Sultany*1, Ban Mahmood Shaker Al-joda2, Mohammed Kadhum Al-Hattab3

1MSc Student at Dep. of Clinical Biochemistry, College of Medicine, Babylon University, Iraq
2Assistant Professor at Dep. of Clinical Biochemistry, College of Medicine, Babylon University, Iraq
3Professor at Hammurabi College of Medicine, Babylon University, Iraq

*Corresponding author: Nazar Hamdan Jassem Al-Sultany.
nazarhamdan3@gmail.com

Abstract

Background: Psoriasis is an immune-mediated, chronic inflammatory disease of genetic basis, which affects mainly the skin, although it has systemic pathological effects. The most severe forms have been associated with several diseases that have similar pathogenic factors. Many studies showed that trace elements play vital role in some inflammatory responses such as psoriasis. The aim of current study was to estimate the levels of serum trace elements (zinc, copper and Cu/ Zn ratio) in psoriatic patients and evaluate the impact of these values on the severity and pathogenesis of psoriasis. Methods: In this case-control study, (50) patients with psoriasis were divided into three subgroups (mild, moderate and severe) and (50) healthy controls were examined. PASI score for each patient was calculated. Serum levels of Cu and Zn were measured by Flameless Atomic Absorption Spectrophotometer and Cu/ Zn ratio was calculated. Results: After measurements and comparisons between psoriatic patients and age-, and gender-, matched control group, results showed significant differences in copper and Cu/ Zn ratio among these groups, but no significant differences in serum zinc were showed. There was significant increase in serum copper and Cu/ Zn ratio (P value = 0.017 and 0.032 for copper and Cu/ Zn ratio, respectively) for psoriatic patients as compared with control group. Results also showed no significant differences in serum zinc between psoriatic patients and control group. No significant differences in the concentration of serum copper were observed between females and males of patients group, but highly significant increase of serum zinc in female as compared with males of psoriatic patients. Conclusion: increased serum copper may play a major role in
increasing the inflammatory response in psoriatic disease. No apparent relationship was observed in our study between psoriasis pathogenesis or severity and level of serum zinc. In addition, Cu/Zn ratio is a good marker for measuring severity of psoriasis.

**Keywords:** Psoriasis, PASI, copper, zinc, Cu/Zn ratio.

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**Introduction**

Psoriasis is a multifactorial, chronic immune-mediated inflammatory disorder of the skin, with a genetic component\(^1\). This condition is characterized by inflammatory skin lesions that typically develop variably, but can affect the entire skin surface. Psoriasis is also considered a systemic inflammatory condition due to its strong association with comorbidities that include psoriatic arthritis, obesity, metabolic syndrome, chronic kidney disease, stroke and cardiovascular disease\(^2\). Some observations highlighted the importance of genetic factors in psoriasis such as greater incidence of psoriasis among first and second degree relatives of patients than among the general population\(^3\). Concordance rates between monozygotic twins are up to 3 times higher than among dizygotic twins\(^4\). Psoriasis is multifactorial and involves the interaction of individual genotypes with environmental, infectious and lifestyle factors. The human leukocyte antigen (HLA)-class I allele. HLA-Cw6 is the main psoriasis risk gene, which proved by Sequence-based methods in large samples\(^5,6\). Psoriasis classified into many forms according to morphology, degree of severity and site of the lesion\(^7\). Chronic plaque psoriasis is the commonest form of psoriasis, representing almost 90% of psoriatic patients\(^8\). Copper is an important trace element that is associated with various metalloproteins. Copper metalloenzyme superoxide dismutase (SOD) protects against random free-radical damage both in the cytoplasm and in blood plasma\(^9\). Zinc plays important structural and catalytic roles in the body. Zinc fingers are super secondary structures in proteins, such as transcription factors, that bind DNA and regulate gene expression. Hundreds of enzymes require Zn for activity\(^10\). Current study was aimed to estimate the levels of serum trace elements (zinc, copper and Cu/Zn ratio) in psoriatic patients and evaluate the impact of these values on the severity and pathogenesis of psoriasis.
Materials and Methods

Patients and controls were aged from 22 to 60 years with an average ± SD (39.16±10.96 and 39.32±10.5) years for patients and controls, respectively. Subjects were collected from outpatient clinic of dermatology at Mirjan Teaching Hospital and Al-Imam Al-Sadiq hospital in Hilla city, Iraq. All patients and controls gave their consents. Severity of psoriasis was determined by psoriasis area and severity index score (PASI), and divided into (mild, moderate and severe). Body mass index was calculated by the equation (BMI= Kg/m²). Blood samples were drawn from patients and control subjects, three to five milliliters of blood were obtained from mild, moderate and severe psoriatic patients, and controls, then collected into tubes without anticoagulants and left for 15 minutes at room temperature to clot. After that, the blood samples were centrifuged at 1000-2000xg for approximately 10 minutes. Then the sera were aspirated and stored at (-20°C) until time of use. Samples were measured by Flameless Atomic Absorption Spectrophotometer (FAAS). Exclusion criteria in this study were hypertensive patients, diabetic patients, pregnant women, patients with other skin diseases, BMI <18 or >24.9, alcoholic patients, smoker patients and patients taking treatment or supplements containing zinc, copper or selenium.

Results

Regarding serum copper, results showed significant increase in psoriatic patients as compared with control group (P= 0.017), with mean±SD (77.61±10.18)µg/dl for patients and (69.14±19.49)µg/dl for controls (Table 1).
Table (1): Comparisons of serum levels of copper, zinc and Cu/Zn ratio between psoriatic patients and their controls

<table>
<thead>
<tr>
<th>Trace elements</th>
<th>Subject</th>
<th>No.</th>
<th>Mean (µg/dl)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>Patients</td>
<td>50</td>
<td>77.61±10.18</td>
<td>0.017</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>50</td>
<td>69.14±19.49</td>
<td></td>
</tr>
<tr>
<td>Zinc</td>
<td>Patients</td>
<td>50</td>
<td>74.99±26.2</td>
<td>0.877</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>50</td>
<td>74.29±16.85</td>
<td></td>
</tr>
<tr>
<td>Cu/Zn ratio</td>
<td>Patients</td>
<td>50</td>
<td>1.18±0.49</td>
<td>0.032</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>50</td>
<td>0.97±0.36</td>
<td></td>
</tr>
</tbody>
</table>

Comparison of serum copper among psoriatic patients groups showed highly significant differences among these groups (P<0.00001) with mean±SD (68.79±5.5, 77.03±8.1, 87.9±5.8)µg/dl for mild, moderate, and severe psoriasis, respectively (Table 2). No significant differences in the concentration of serum copper were observed between females and males of patients group.

Table (2): Comparison of serum copper among psoriatic patients groups

<table>
<thead>
<tr>
<th>Psoriasis group</th>
<th>No.</th>
<th>Mean (µg/dl)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>18</td>
<td>68.79±5.5</td>
<td>&lt;0.00001</td>
</tr>
<tr>
<td>Moderate</td>
<td>16</td>
<td>77.03±8.1</td>
<td></td>
</tr>
</tbody>
</table>
Severe | 16 | 87.9±5.8

There was a highly significant positive correlation between serum copper level, and psoriasis area and severity index (PASI score) of the patients groups (P<0.0001, r= 0.8) which indicated a positive association between level of serum copper and severity of psoriasis (Figure 1). Our results revealed no significant differences between psoriatic patients and healthy controls related to the concentration of serum zinc (P=0.88), with mean±SD value (74.99±26.2, 29±16.85)µg/dl for patient and control groups, respectively (Table 1).

Our study also showed no significant differences among groups of psoriatic patients regarding serum zinc concentration (P= 0.47; Table 3)and highly significant increase of serum zinc in female as compared with males of psoriatic patients (P<0.01).

Figure (1): Correlation of serum copper and PASI score.
Table (3): Comparisons of serum zinc levels among psoriatic groups

<table>
<thead>
<tr>
<th>Psoriasis group</th>
<th>No.</th>
<th>Mean (µg/dl)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>18</td>
<td>81.1±30.08</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>16</td>
<td>72.28±16.66</td>
<td>0.469</td>
</tr>
<tr>
<td>Severe</td>
<td>16</td>
<td>70.82±29.47</td>
<td></td>
</tr>
</tbody>
</table>

There was no significant correlation between serum zinc level and severity of psoriasis (P=0.64, r= -0.07; Figure 2).
Regarding Cu/Zn ratio, it was significantly high in psoriatic patients when compared with control group ($P = 0.032$) with mean±SD (1.18±0.49, 0.97±0.36) for patient and control groups, respectively (Table 1). Comparison among psoriatic groups (mild, moderate, severe) showed significant differences regarding Cu/Zn ratio ($P = 0.029$; Table 4).

**Table (4):** Comparison of serum Cu/Zn ratio among patients groups

<table>
<thead>
<tr>
<th>Psoriasis group</th>
<th>No.</th>
<th>Mean</th>
<th>$P$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>18</td>
<td>1.02±0.52</td>
<td>0.029</td>
</tr>
<tr>
<td>Moderate</td>
<td>16</td>
<td>1.11±0.23</td>
<td></td>
</tr>
<tr>
<td>Severe</td>
<td>16</td>
<td>1.44±0.56</td>
<td></td>
</tr>
</tbody>
</table>

**Figure (2):** Correlation of serum zinc and PASI score.
Correlation of Cu/Zn ratio with the severity index of these groups revealed significant positive relationship ($P=0.04$, $r=0.29$; Figure 3).

![Figure 3](image_url)

**Figure (3)** Correlation of serum Cu/ Zn ratio and PASI score.

**Discussion**

In our study there was significant increase of serum copper in patients compared with control group. This result was in agreement with (11,12) who recently found a significant increase of serum copper in patient with psoriasis. Our results were discrepant with (13), who recently found no significant differences of serum copper in psoriatic patients when compared with control group. There were significant differences in serum copper regarding severity of the disease, this result agreed with (14) who found significant differences among psoriatic groups regarding serum copper. In opposite, (15) recently found no significant differences among these groups regarding serum copper. Copper is an important trace metal presents in the serum in at least two fractions; a transport fraction (5%), which is loosely bound to albumin and ceruloplasmin, and (95%) is firmly bound to globulin. It is important to note that serum copper largely reflects serum ceruloplasmin and is not a sensitive indicator of copper nutritional status (16). Serum ceruloplasmin is an acute phase protein, and its levels are known to increase by 50% or more.
under certain conditions of physical stress such as trauma, inflammation or disease. Because over 90% of serum copper is carried by ceruloplasmin, which is increased in many inflammatory conditions, elevated serum copper may simply be a marker of inflammation (17). Zinc is important cofactor and modulator of many critical biological functions in skin disorders including psoriasis. The protective role of Zn against oxidative stress has been reported, therefore alterations in Zn serum level could be responsible for the changes in peroxidant-antioxidant balance observed in psoriasis (18). In our study no significant differences of serum zinc were found between psoriatic patients and controls. Also, (18,19) recently found no significant differences in serum zinc between healthy controls and psoriatic patients. On the other hand, (20) recently found significant increase of serum zinc in patients with psoriasis when compared with healthy group while (11) found significant decrease of psoriatic serum zinc in relation to healthy controls. Our study also showed no significant differences in serum zinc regarding severity of the disease, this result agreed with (21) who recently found no significant differences between psoriatic groups regarding serum zinc, and no significant correlation between serum zinc and PASI score. In contrast, F et al (22) recently observed a significant differences in serum zinc between these groups. Moreover, current study revealed significant increase in serum Cu/Zn ratio of psoriatic patients compared with control group. This increase is related to serum copper which is increased in psoriatic patient as previously mentioned, this agreed with (23) who found a significant increase in that ratio in psoriatic patients compared with control group and disagreed with (20) who recently found significant decrease of Cu/Zn ratio in psoriatic patients related to control group. Decreased positivity and significance in results between copper and Cu/Zn ratio regarding their correlation with PASI score was due to the scattered values of serum zinc which didn’t correlate with psoriatic severity. This result agreed with (21) who reported that Cu/Zn ratio was significantly increased in severe psoriasis compared with mild group, and positively correlated with PASI score, but disagreed with Shahidi DM et al (23), who found no significant differences between these groups.

**Conclusion**

Since copper may increase the oxidative damage to lipids, proteins and DNA, increased serum copper may play a major role in increasing the inflammatory response in psoriatic disease. No apparent relationship was observed in our study between psoriasis pathogenesis or severity and
level of serum zinc. In addition, Cu/ Zn ratio is a good marker for measuring severity of psoriasis, but it may be influenced by zinc concentration that could be scattered in psoriatic disease.

**Ethical Clearance:** The research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq.

**Conflict of interest:** The authors declare that they have no conflict of interest.

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**References**


