

ORIGINAL ARTICLE

Comparative Analysis of Levels of Iron, Copper, Transferrin, and Ceruloplasmin in Serum of the Patients of Psoriasis

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ABSTRACT

Objective: To conduct a comparative analysis on the serum levels of transferrin, ceruloplasmin, copper, and iron in the serum of patients suffering from psoriasis.

Methodology: It was a case-controlled comparative study conducted on a group of 40 individuals suffering from psoriasis, and another group of 40 healthy individuals. The levels of iron, copper, ceruloplasmin, and transferrin in serum were evaluated directly. The severity of the disease was observed by psoriasis area and severity index (PASI), and the association between PASI score and disease severity.

Results: The study involved 40 psoriatic patients, and 40 healthy individuals, and it was observed that iron, and transferrin levels were statistically low in the patients suffering from psoriasis as compared to healthy individuals. However, there was no significant difference observed between the two groups in terms of levels of copper in serum.

Conclusion: The study concluded that there is an involvement of trace elements in the serum of psoriatic patients.

INTRODUCTION

Among the hyperproliferative and chronic inflammatory disorders of skin, psoriasis is one of the major cutaneous disorders which have an impact of affecting 2% population across the world and play a key role in increasing the health burden of middle- and low-income countries.¹ It has been established that trace elements have an involvement in inducing inflammatory and immunological reactions in the body.² Similarly, psoriasis also being an inflammatory disorder is worsened by the trace elements, and oxidative stress in the body.³ Although trace metals can cause worsening of psoriasis, still very little research has been conducted to identify the connection between psoriasis and metal binding proteins. During inflammation, trace elements such as iron and copper are redistributed in serum along with a marked increase in the acute phase proteins such as ceruloplasmin.⁴ Different interleukins are responsible for this increase which use a dose dependent method for their liberation. Activated macrophages when encounter different stimuli such as infection, stress, and trauma release these cytokines which have a role in the pathogenesis of psoriasis.

In the epidermis of patients having psoriasis, increased concentrations of iron have been found. Iron is generated by a rate limiting enzyme (heme oxygenase) involved in the catabolism of heme as a byproduct along with carbon monoxide and biliverdin.⁵ Heme oxygenase is usually produced in response to stress and have antioxidant and cryoprotective properties. Similarly, transferrin also has a central role in the metabolism of iron in which it serves as a carrier molecule; it also has a role in the transport of zinc.⁶

The current study was conducted to assess the levels of iron, copper, ceruloplasmin, and transferrin in serum of the psoriatic patients.

METHODOLOGY

It was a case control study for the assessment of the levels of iron, copper, transferrin, and ceruloplasmin in serum, and the link

between severity of psoriasis and the presence of trace elements in serum. The study included patients who visited the dermatology department of CMH Peshawar during March 2022 till May, 2022. Another group of healthy individuals of same number was recruited and the group was named as control. The study was approved by the ethical review committee of the institute. The study included patients who were pathologically and clinically diagnosed as plaque psoriasis, and it was made sure that such patients had not received any kind of topical treatment from last 3 months. Psoriasis area severity index was used to grade the plaques of psoriasis when blood was collected, if the plaques were less 10, they were graded as mild whereas if they were more than 10, they were graded as severe. Expecting or lactating women were excluded from the study, also the individuals who were having any medicines which can alter the serum levels of trace elements such as diuretics were also excluded from the study. Similarly, the individuals having diabetes, malignancy, or any kind of metabolic disorder were also excluded from the study. A written informed consent was obtained from every patient before the study. For the analysis, serum samples were collected without any anticoagulant and were centrifuged at 3000 rpm/5 min. The levels of trace elements in serum were analyzed by using the direct spectrophotometric method. The levels of transferrin and ceruloplasmin were assessed by iron ferene and immunoturbidimetry assays. For statistical analysis SPSS was used and P-value less than or equal to 0.05 was considered as significant.

RESULTS

The current study included 40 healthy individuals and 40 psoriatic patients whose clinical and demographic characteristics are given in table number 1.

Table 1: Demographic and clinical characteristics of the subjects included in the study

| Characteristics | Psoriatic patients | | | Healthy individuals n=40 |
|--|--------------------|-------------|---------------|-----------------------------|
| | Total (n=40) | Mild (n=14) | Severe (n=26) | |
| Disease duration in years | | | | |
| Range in median | 9 (0.08-42.0) | 6 (0.08-20) | 10 (0.5-42) | - |
| Mean | 10 | 7.5 | 11.7 | - |
| Psoriasis area and severity index (Score range = 0-72) | | | | |

| | | | | |
|-----------------|-------------|-------------|--------------|------------|
| Range in median | 12 (2.4-54) | 6 (2.4-9.6) | 16 (10.8-54) | - |
| Mean | 5.9 | 18 | 14 | - |
| Age in years | | | | |
| Range in median | 33 (8-66) | 31 (8-66) | 36 | 33 (10-66) |
| Mean | 36.25 | 35 | 36 | 37 |
| Gender | | | | |
| BMI | 24 | 25 | 25 | 24 |
| Female | 18 | 7 | 11 | 16 |

No statistical difference was observed between the groups in terms of demography. Similarly, the disease duration was not also significantly different between different grades of psoriasis i.e., mild and severe as the p-value obtained from t-test was 0.12. The mean concentrations of iron, copper, ceruloplasmin, and transferrin in serum of both groups are given in table number 2.

Table 2: Mean concentration of iron, copper, transferrin, and ceruloplasmin in patients having psoriasis

| Trace elements | Psoriatic patients | | | Healthy individuals n=40 |
|------------------------------|--------------------|-------------|---------------|-----------------------------|
| | Total (n=40) | Mild (n=14) | Severe (n=26) | |
| Transferrin (g/L) | 3.25 | 3.3 | 3.2 | 3.7 |
| Ceruloplasmin (mg/L) | 3.54 | 3.7 | 3.5 | 3 |
| Iron ($\mu\text{mol/L}$) | 19.39 | 19.43 | 19.37 | 21.9 |
| Copper ($\mu\text{mol/L}$) | 19.5 | 19.5 | 19.5 | 18.8 |

Table number 2 exhibited that the levels of iron and transferrin were lower in individuals who were affected with psoriasis when compared with the serum levels of healthy individuals. A significant difference was observed, and the P-value obtained was < 0.01. However, a significant elevation was observed in the levels of ceruloplasmin in serum when compared with control and the P-value obtained was 0.02. There was no statistically significant difference observed between both groups when the serum values of copper were compared, and the obtained P-value was 0.10. Mild and severe psoriatic patients exhibited no statistically significant difference in the serum levels with an obtained P-value, 0.28. However, it was identified that there was no correlation existed significant enough between serum levels and PASI score, and similarly, no association existed between serum levels and duration of disease.

DISCUSSION

It has been an established fact that trace elements and oxidative stress have a role in the production of ROS, and thereby exert an impact on the worsening of psoriasis.⁷ This implies that trace elements might involve in the pathogenesis of psoriasis. It has been reported by a study conducted by Basavaraj et al. that iron was present in low levels in the sera of both severe and mild psoriatic patients.⁸ This finding correlated with our findings; however, we were failed to establish a relationship between the serum iron levels and severity of psoriasis. These low iron levels could be due to the exfoliation related cell loss.⁹ Studies prove that transferrin and ceruloplasmin are usually higher in active psoriasis.¹⁰ However, we observed that transferrin levels were reduced in psoriatic patients which could be due to the loss of iron and other proteins due to exfoliation. We observed that iron levels were decreased in psoriatic patients, which could be due to the decreased levels of transferrin. We observed that the levels of copper were not different in both groups. One study reported a positive correlation between serum copper levels and psoriasis severity, but we were failed to establish any relationship between the two.¹¹ We also observed that there was a marked increase in ceruloplasmin however, the association didn't exist between the levels of ceruloplasmin and disease severity. It is postulated though that this increase could be due to the inflammation during the active disease phase. There was no trace element involved in the chronicity of psoriasis. The increase or decrease in the levels of trace elements and proteins in serum might have a role in the progression of psoriasis by inducing inflammation, aggravating

immune response or by the induction of the generation of reactive oxygen species.¹²

The current study also had certain limitations such as this study was conducted on a small scale, and future studies are recommended on a larger sample size. Another future recommendation is that the study should assess the levels of trace elements not only in serum but in lesional skin, and urine too.

Conflict of interest: None

Source of funding: None

Ethical approval: Study was ethically approved by the ethical review committee of the institute.

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