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ORIGINAL ARTICLE

Association of Abnormal Serum Copper and Zinc Levels with Psoriasis Severity

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ABSTRACT

Background: Psoriasis is a chronic, recurring inflammatory skin disease characterized by red, scaly patches that can cause considerable discomfort and affect the patient's daily life. This study aims to reveal abnormalities in psoriasis patient serum copper and zinc levels.

Materials and Methods: This cross-sectional study was conducted in District Headquarters Hospital Nowshehra from February 2021 to February 2023. Two hundred fifty participants with psoriasis were enrolled. Data was collected from the demographic information of each participant, including age, sex, and clinical history. Peripheral blood samples were collected from the participants in the fasting state after an overnight fast and centrifuged at 3000rpm to extract the serum. Serum concentrations of copper and zinc were measured using standardized laboratory procedures.

Results: The study included two hundred fifty patients of both genders. The mean age was 42.98±8.01 years for the psoriasis group and 40.01±7.23 years for the healthy control group. Regarding gender distribution, 60% of psoriasis patients and 52% of healthy controls were male. Patients with psoriasis showed elevated serum copper levels (120 ± 15 µg/dL) compared to healthy controls (110 ± 12 µg/dL) ($p<0.001$). Conversely, their serum zinc levels were lower (90 ± 10 µg/dL) compared to healthy controls (100 ± 8 µg/dL) ($p<0.001$).

Study Findings: Our study reveals an alarming level of serum copper and zinc concentration deviation among psoriasis patients, which signifies a possible disturbance of trace metal equilibrium in the body due to psoriasis.

Keywords: Psoriasis, Serum copper, Serum zinc, Trace metal imbalance, Psoriasis severity

INTRODUCTION

Psoriasis, which is painful for the people affected by it, is a chronic inflammatory condition of the skin that causes the appearance of red, scaly areas on the skin. It is inflicting more disability among the population. It has been established that more work needs to be done to determine the exact causes of this ailment[1]. However, in the current literature, it has been determined that specific facilitate this condition, such as the level of zinc, copper, iron, and lead, among others. An individual's immune function and skin health are heavily dependent on Copper and Zinc. In addition to copper, some reports have identified the connection between abnormal levels of anti-hypersensitive serum and copper lupus psoriasis disease[2, 3]. There are many more that introduce the branched chain relationship between these elements and the skin disorder psoriasis[4]. This chronic skin disorder is characterized by inflammation of all the skin tissues and the formation of red scaly patches in some body regions. There are multiple cases whereby patches can be seen on the body surface, but that is not as typical as getting them in some select areas. Its fundamental pathology revolves around the rapid multiplication of keratinocytes in the basal layer of the epidermis[5]. Indeed, psoriasis extends beyond skin and joint manifestations, showing associations with metabolic syndrome, obesity, cardiovascular disorders, and mental health challenges. These connections significantly influence patients' overall well-being and quality of life[6]. Worldwide prevalence varies, with higher rates in Europe and the United States (1%–3%) compared to Asia (0.3%). Psoriasis can emerge at any point in life, yet it frequently appears between the ages of 15 and 30 years, showing no notable discrepancy between genders[7]. Those with a family history of psoriasis face an elevated risk of developing the condition themselves[8]. Psoriasis, a multifactorial disease with a genetic predisposition, is typified by a defect in keratinization. Some studies have reported notably low serum levels of zinc and copper in psoriatic patients, while others have found levels within the normal range.

Furthermore, a noticeable reduction in serum zinc is evident in psoriasis, and this does not show improvement even after receiving oral zinc therapy[9]. Psoriasis has a very variable prevalence, ranging from 0.6% to 4.8%. Psoriasis vulgaris affects both men and women, though it tends to be encountered by the female population at a younger age[10]. The molecular pathway associated with the disorder remains unknown, yet the disorder is often inherited and sometimes triggered by infections. Other researchers have well-documented Wilson's disease, Menke's kinky hair disease, and Acrodermatitis enteropathica, which are abnormal copper metabolism and zinc deficiency[11]. Other skin diseases, including acne vulgaris, lichen planus, and ichthyosis, may also be linked to zinc deficiency, as Xie et al. discovered and showed. This means abnormalities in the metal metabolism may also be associated with psoriasis[12]. Serum copper and zinc levels and psoriasis are related, and understanding this relationship is critical to understanding the pathogenesis of the disease and developing new ways of treating it[13]. The current study aims to estimate the abnormal serum zinc and copper levels in psoriasis and compare them with healthy individuals. Furthermore, a gender-based comparison was done to identify different factors in patients with psoriasis.

MATERIALS & METHODS

We conducted this cross-sectional study at the District Headquarters Hospital, Nowsheh, RA, between February 2021 and February 2023. The data were collected from 250 psoriasis patients. All patients included in the study were diagnosed with psoriasis based on clinical assessment and histopathological evidence, and they were over 18 years of age. However, systemic diseases and other chronic skin disorders, known to affect the levels of zinc and copper in the body, were used as exclusion criteria. Each patient age, sex, and medical history were captured in detail. Blood samples were collected after fasting overnight and

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spun in a centrifuge at 3000 rpm to separate serum. Laboratory copper and zinc assays were done to ascertain each patient's levels of copper and zinc. Further, the serum levels of zinc and copper were also related to other disease severity assessment scales such as the Psoriasis Area and Severity Index (PASI). Clinical information, including psoriasis duration, comorbidities, and ongoing treatment, was also collected through absorption spectrophotometry, and standard biochemical assays were used to determine serum copper and zinc levels. General descriptive statistics were used to describe the variables while inferences analysis of variance (ANOVA) was applied. Supplements in the form of mean serum copper and zinc levels were provided for the control, and the study groups and comparisons were made using Tukey's Honestly Significant Difference (HSD) test. In this study, a p-value of less than 0.05 was statistically significant; this applied to all tests and results. All statistical analyses were performed using SPSS software, version 23.

RESULTS

Data were collected from 250 patients, both male and female. The mean age was 42.98±8.01 years in the diseases group and 40.01±7.23 in healthy controls. The gender distribution showed that 60% of the Psoriasis group and 52% of the healthy controls were male. The mean BMI was slightly higher in the Psoriasis group (25.5 ± 2.5 kg/m²) than the healthy controls (24.5 ± 2.0 kg/m²). Among the participants, 32% of those with Psoriasis and 24% of healthy controls reported smoking, as shown in (Table 1).

Table 1: Demographic and baseline data of Psoriasis patients

Characteristic	Psoriasis Group (n=250)	Controls Group (n=250)
Age (years), mean ± SD	42.98 ± 8.01	40.01 ± 7.23
Gender (M/F), n (%)		
- Male	150 (60%)	130 (52%)
- Female	100 (40%)	120 (48%)
BMI (kg/m²), mean ± SD	25.5 ± 2.5	24.5 ± 2.0
Smoking (Y/N), n (%)		
- Yes	80 (32%)	60 (24%)
- No	170 (68%)	190 (76%)
Disease Duration (years), mean ± SD	6.01 ± 3.22	-

Table 2: Serum copper and zinc levels in psoriasis patients

Parameter	Psoriasis Group	Healthy Controls	p-value
Serum Copper (µg/dL), Mean ± SD	120 ± 15	110 ± 12	<0.001
Serum Zinc (µg/dL), Mean ± SD	90 ± 10	100 ± 8	<0.001
Serum Albumin (g/dL), Mean ± SD	4.5 ± 0.3	4.8 ± 0.4	<0.001
Serum Globulin (g/dL), Mean ± SD	3.2 ± 0.5	3.0 ± 0.4	<0.05
Alkaline Phosphatase (U/L), Mean ± SD	70 ± 10	65 ± 8	<0.05

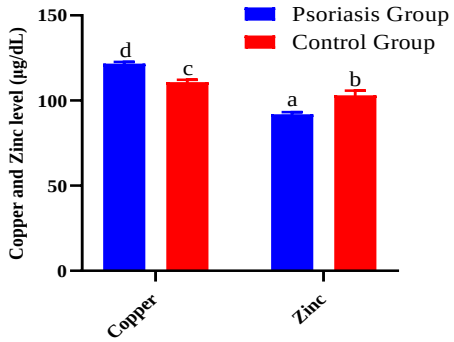

Figure 1: Comparison of serum copper and zinc in psoriasis and control group.

Psoriasis patients exhibited higher levels of serum copper (120 ± 15 µg/dL) compared to healthy controls (110 ± 12 µg/dL) ($p<0.001$). Conversely, serum zinc levels were lower in the Psoriasis group (90 ± 10 µg/dL) than in healthy controls (100 ± 8 µg/dL) ($p<0.001$). Additionally, Psoriasis patients had lower serum albumin levels (4.5 ± 0.3 g/dL) compared to healthy controls (4.8 ± 0.4 g/dL) ($p<0.001$). Serum globulin levels were higher in Psoriasis patients (3.2 ± 0.5 g/dL) compared to healthy controls (3.0 ± 0.4 g/dL) ($p<0.05$). Furthermore, Psoriasis patients exhibited elevated alkaline phosphatase levels (70 ± 10 U/L) compared to healthy controls (65 ± 8 U/L) ($p<0.05$) shown in (Table 2). These comparisons of serum copper and serum zinc in Psoriasis and the control group are statistically shown in (Figure 1).

Psoriasis patients exhibited lower levels of haemoglobin (13.5 ± 1.2 g/dL) compared to healthy controls (14.2 ± 1.0 g/dL) ($p<0.001$), indicating a potential association with anaemia in psoriatic individuals. Additionally, Psoriasis patients had a higher total white blood cell (WBC) count (7500 ± 1000 /µL) compared to healthy controls (7200 ± 800 /µL) ($p<0.05$), suggesting an inflammatory response in psoriatic conditions. Furthermore, platelet count was lower in Psoriasis patients (280 ± 50 x10^3/µL) compared to healthy controls (300 ± 40 x10^3/µL) ($p<0.01$), possibly indicating alterations in thrombotic processes. Moreover, Psoriasis patients exhibited elevated erythrocyte sedimentation rate (20 ± 5 mm/hr) compared to healthy controls (15 ± 4 mm/hr) ($p<0.001$), indicating increased inflammation or tissue damage shown in (Table 3).

Table 3: Comparison of hematological parameters in psoriasis as compared to healthy controls

Parameter (mean±SD)	Psoriasis Group	Healthy Controls	p-value
Hemoglobin (g/dL)	13.5 ± 1.2	14.2 ± 1.0	<0.001
Total WBC Count (/µL)	7500 ± 1000	7200 ± 800	<0.05
Platelet Count (x10^3/µL)	280 ± 50	300 ± 40	<0.01
Erythrocyte Sedimentation Rate (mm/hr)	20 ± 5	15 ± 4	<0.001

The correlation analysis showed a notable positive correlation between serum copper levels and the severity of psoriasis, evidenced by a correlation coefficient (r) of 0.60 ($p<0.05$). This suggests that elevated serum copper levels may be linked to increased psoriasis severity. However, no significant correlation was detected between serum zinc levels and psoriasis severity, as indicated by a correlation coefficient (r) of -0.10 ($p>0.05$). Moreover, when comparing serum copper and zinc levels based on the duration of the disease, interesting patterns emerged. Patients with a disease duration of less than five years exhibited a mean serum copper level of 115 ± 12 µg/dL and a mean serum zinc level of 85 ± 8 µg/dL. Conversely, patients with a disease duration exceeding five years displayed higher mean serum copper levels of 125 ± 14 µg/dL but lower mean serum zinc levels of 75 ± 10 µg/dL, as illustrated in (Table 4**)**.

Table 4: Correlation between PASI Scores and Serum Copper/Zinc Levels in Patients with Psoriasis

Parameter	Correlation Coefficient (r)	p-value
Serum Copper Level	0.60	<0.05
Serum Zinc Level	-0.10	>0.05
Disease Duration	Serum Copper Level (µg/dL)	Serum Zinc Level (µg/dL)
<5 years (n=125)	115 ± 12	85 ± 8
>5 years (n=125)	125 ± 14	75 ± 10

DISCUSSION

The results from this study highlight notable changes in serum copper and zinc levels in individuals with psoriasis when compared to healthy controls. Psoriatic patients exhibited higher serum copper levels and lower serum zinc levels, suggesting a potential disruption in trace metal balance linked to the condition's pathogenesis[14]. The observed elevation in serum copper levels

may be attributed to the chronic inflammatory state characteristic of psoriasis. During inflammation, ceruloplasmin, a protein that carries copper, is synthesized, leading to increased levels of serum copper in the body[15]. Furthermore, the disturbance in the equilibrium of metallothionein, a protein that binds with zinc and regulates the zinc body concentration, may help understand the decreased zinc serum levels associated with psoriasis[16]. The analysis introduced a statistically significant positive correlation between serum copper and serum zinc concentration, established in the analyzed group. This strong correlation raises important questions regarding zinc and copper metabolism in the development of psoriasis. Zinc is a crucial trace element that plays a vital role in various physiological processes within the body[17]. Zinc is a crucial trace element that plays a vital role in various physiological processes within the body. There are several functions, such as DNA and RNA repair, enzyme regulation, and antioxidant mechanisms, where zinc is vital[18, 19]. It is also very effective in regulating keratinization, immune function, and the activity of enzymes and, therefore, is important in the pathophysiology of psoriasis. The correlation between the serum concentrations of zinc and the disease is still under investigation[20]. Some studies, such as Butnaru et al., have shown that serum zinc levels increase in patients with psoriasis. In contrast, others, like Ala et al., Cao et al., Halevy et al., and Tasaki et al., have found no such differences compared to control healthy groups[21]. On the contrary, some studies show lower serum zinc levels in psoriasis patients [21]. Dissimilar results highlight the complexity of how zinc is metabolized in psoriasis and its specific role in the disease process, which needs to be explored further[22]. Furthermore, these results highlight the relevance of evaluating serum concentrations of metals in psoriatic patients to elucidate its pathophysiological background further and unravel new therapeutic strategies through trace elements homeostasis management. These findings require further confirmation through additional studies and will help evaluate the potential role of modulating copper and zinc status in managing psoriasis.

CONCLUSION

Serum copper and zinc levels are higher/ lower in psoriasis patients than in controls. A dysregulation of trace metal homeostasis has been associated with psoriasis. The association between serum copper and zinc might reflect the interaction of these metals in the pathogenesis of psoriasis. Despite this, the heterogeneity of these data highlights the importance of additional research to clarify the mechanistic basis of this relationship and its implications for psoriasis management.

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