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Research Article

# EVALUATION OF TRACE ELEMENTS ZINC & COPPER INIRAQI PATIENTS WITH PSORIASIS & EXTENT OF THE DISEASE

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**ABSTRACT**

**Background**: Psoriasis is a chronic skin condition that is often associated with systemic manifestations, especially arthritis. An estimated 2 percent of U.S. adults are affected, and the prevalenceis about equal between men and women. **Objective**: To evaluate trace elements zinc & copper levels in sera of Iraqi patients with psoriasis and the extent of the disease. **Material and methods**: Thirty six subjects were involved in this case control study. Sixteen psoriatic patients (10 males &6 females) with a mean age of 36 ± 15.5 years and control group was comprised of twenty volunteers( 11 males & 9 females) with a mean age of 31.1±17.4 years. **Results**: There was a highly significant decrease of mean serum level of Zn in G2 (0.068 ± 0.038µg/g p value <0.0001) compared with mean serum level of it in G1 (1.036 ± 0.16µg/g).There was a highly significant decrease of mean serum level of Cu in G2 (0.036 ± 0.019 µg/g p value<0.0001) compared with mean serum level of it in G1 (1.042 ± 0.20 µg/g). **Conclusion:** Psoriatic lesions retain a high content of zinc compared with uninvolved skin suggesting an imbalance in zinc distribution between serum and psoriatic lesions, exfoliation of large quantities of skin can thus decrease the serum levels of zinc. The serum copper findings in psoriasis merely represent a non-specific response to an inflammatory process.

**Keywords:** Psoriasis , Zinc , Cupper , Trace elements.

## INTRODUCTION

Psoriasis is a chronic skin condition that is often associated with systemic manifestations, especially arthritis. An estimated 2 percent of U.S. adults are affected, and the prevalenceis about equal between men and women[1].

Psoriasis can develop at any age, but onset is most likely[1].between 15 and 30 years of age.

The clinical course is unpredictable[2]. Individualized and carefully monitored therapycan minimize morbidity and enhance quality of life.

Approximately one-third of patients withpsoriasis have a first-degree relative with the condition. Research suggests a multifactorial mode of inheritance[2-3].

Many stressful physiologic and psychological events and environmental factors are associated with the onset and worsening of the condition. Direct skintrauma can trigger psoriasis (Koebner phenomenon). Streptococcal throat infection may also trigger the condition or exacerbateexisting psoriasis.

Human immunodeficiency virus infection has not been shown totrigger psoriasis, but can exacerbate existing disease. As the infection progresses, psoriasis often worsens[1].

Smoking increases the risk of psoriasis and its severity [1,4].Obesity and alcohol use andabuse are also associated with psoriasis[4,5].These associations may not be causative; patients with psoriasis may be more susceptible to unhealthy behaviors.

### Pathophysiology

Psoriasis is an immune-mediated disease with genetic predisposition, but no distinct immunogen has been identified. The presence of cytokines, dendritic cells, and T lymphocytes in psoriatic lesions has prompted the development of biologic therapies[6].

### Zinc

Zinc is an essential mineral perceived by the public today as being of "exceptional biologic

and public health importance", especially regarding prenatal and postnatal development[7]. Zinc deficiency affects about two billion people in the developing world and is associated with many diseases[8]. In children it causes growth retardation, delayed sexual maturation, infection susceptibility, and diarrhea[7]. Enzymes with a zinc atom in the reactive center are widespread in biochemistry, such as alcohol dehydrogenase in humans[9]. Consumption of excess zinc can cause ataxia, lethargy and copper deficiency.

Zinc is an essential trace element for humans[10] and other animals,[11] for plants[12] and for microorganisms[13]. Zinc is found in nearly 100 specific enzymes[14] (other sources[15] say 300), serves as structural ions in transcription factors and is stored and transferred in metallothioneins[16]. It is "typically the second most abundant transition metal in organisms" after iron and it is the only metal which appears in all enzyme classes[12].

In proteins, Zn ions are often coordinated to the amino acid side chains of aspartic acid, glutamic acid, cysteine and histidine. The theoretical and computational description of this zinc binding in proteins (as well as that of other transition metals) is difficult[17].

There are 2-4 grams of zinc[18] distributed throughout the human body. Most zinc is in the brain, muscle, bones, kidney, and liver, with the highest concentrations in the prostate and parts of the eye [19]. Semen is particularly rich in zinc, which is a key factor in prostate gland function and reproductive organ growth[20].

In the brain, zinc is stored in specific synaptic vesicles by glutamatergicneurons[21] and can "modulate brain excitability".[7] It plays a key role in synaptic plasticity and so in learning[22]. However, it has been called "the brain's dark horse"[21] because it also can be a neurotoxin, suggesting zinc homeostasis plays a critical role in normal functioning of the brain and central nervous system.[21] When in excess of biological requirement zinc in mitochondria disrupts major enzyme systems therein culminating in inhibition of OXPHOS and tricarboxylic cycle (TCA) and oxidative stress[23].

In the U.S., the Recommended Dietary Allowance (RDA) is 8 mg/day for women and 11 mg/day for men[24]. Median intake in the U.S. around 2000 was 9 mg/day for women and 14 mg/day in men[25]. Oysters, lobster[26] and red meats, especially beef, lamb and liver have some of the highest concentrations of zinc in food[20].

Zinc supplements should only be ingested when there is zinc deficiency or increased zinc necessity (e.g. after surgeries, traumata or burns)[27],[28]. Persistent intake of high doses of zinc can cause copper deficiency[27].

Zinc deficiency is usually due to insufficient dietary intake, but can be associated with malabsorption, acrodermatitisenteropathica, chronic liver disease, chronic renal disease, sickle cell disease, diabetes, malignancy, and other chronic illnesses[9] Groups at risk for zinc deficiency include the elderly, children in developing countries, and those with renal insufficiency.

**Copper**

Copper is essential to all living organisms as a trace dietary mineral because it is a key constituent of the respiratory enzyme complex cytochrome c oxidase. In molluscs and crustacea copper is a constituent of the blood pigment hemocyanin, which is replaced by the iron-complexedhemoglobin in fish and other vertebrates. The main areas where copper is found in humans are liver, muscle and bone[29]. Copper compounds are used as bacteriostatic substances, fungicides, and wood preservatives.

Copper is an essential trace element in plants and animals, but not some microorganisms. The human body contains copper at a level of about 1.4 to 2.1 mg per kg of body mass[30]. Stated differently, the RDA for copper in normal healthy adults is quoted as 0.97 mg/day and as 3.0 mg/day [31]. Copper is absorbed in the gut, then transported to the liver bound to albumin[32]. After processing in the liver, copper is distributed to other tissues in a second phase. Copper transport here involves the protein ceruloplasmin, which carries the majority of copper in blood. Ceruloplasmin also carries copper that is excreted in milk, and is particularly well-absorbed as a copper source[33]. Copper in the body normally undergoes enterohepatic circulation (about 5 mg a day, vs. about 1 mg per day absorbed in the diet and excreted from the body), and the body is able to excrete some excess copper, if needed, via bile, which carries some copper out of the liver that is not then reabsorbed by the intestine[34],[35].

Because of its role in facilitating iron uptake, copper deficiency can produce anemia-like symptoms, neutropenia, bone abnormalities, hypopigmentation, impaired growth, increased incidence of infections, osteoporosis, hyperthyroidism, and abnormalities in glucose and cholesterol metabolism. Conversely, Wilson's disease causes an accumulation of copper in body tissues.Severe deficiency can be found by testing for low plasma or serum copper levels, low ceruloplasmin, and low red blood cell superoxide dismutase levels; these

are not sensitive to marginal copper status. The "cytochrome c oxidase activity of leucocytes and platelets" has been stated as another factor in deficiency, but the results have not been confirmed by replication[36].

**Subjects and Study design**

Sixteen psoriatic patients (10 males &6 females) with a mean age of 36 ± 15.5 years had been enrolled in this study.

**Control Group**

The control group was comprised of twenty volunteers( 11 males & 9 females) with a mean age of 31.1±17.4 years , all are healthy non –psoriatic with no family history of psoriasis.

**Trace elements Analysis**

Atomic Absorption Flame – Emission Spectrophotometer model AA-6200 Shimadzu-Japan was used for measurements of the concentration of Zn and Cu in serum of patients with psoriasis . 100µlof serum sample was diluted with de-ionized water and analyzed for trace elements concentrations (µg/g).

**Statistical Analysis**

Statistical package for social science (SPSS)version 14.0 for Windows program on thecomputer was used to compare thesignificance in the mean values in thecomparison groups. All data were given asmean ± standard deviation (SD). Student t-Test was applied, $p<0.05$ was consideredstatistically significant.

**RESULTS**

**Effect of Age**

Thirty six subjects were involved in this study.

Group 1 : Control group was comprised of twenty volunteerswith a mean ± SD of age 31.1±17.4 years.

Group 2 :Patient's group represented 16 patients with psoriasiswith a mean ± SD of age 36 ± 15.5 years.

There was nosignificance related to age effect betweenthese two groups $P>0.05$ . Table 1 represents that.

**Effect of Mean ± SD of Zinc**

There was a highly significant decrease of mean serum level of Zn in G2 (0.068 ± 0.038µg/g p value <0.0001) compared with mean serum level of it in G1 (1.036 ± 0.16µg/g). Table 2 represents that.

**Effect of Mean ± SD of Copper**

There was a highly significant decrease of mean serum level of Cu in G2 (0.036 ± 0.019 µg/g p value<0.0001) compared with mean serum level of it in G1 (1.042 ± 0.20 µg/g). Table 2 represents that.

**DISCUSSION**

Psoriasis is a common chronic inflammatory skin disease characterized by a marked increase in keratinocyte proliferation and abnormal differentiation, prominent alterations in dermal capillary vasculature and the presence of dermal and epidermal mononuclear leukocytes and neutrophils[37,38].

A complex interaction between the innate immunity, adaptive immunity and a skin barrier defect is likely to explain the possible pathogenesis of psoriasis, though the response of the disease to biological response modifiers points primarily towards the role of adaptive immunity incausation[39].Oxidative stress has been widely implicated in the pathogenesis of psoriasis. It has been suggested that generation of reactive oxygen species (ROS) from neutrophils, keratinocytes, and fibroblasts can contribute to neutrophil activation, which plays an important role in the psoriatic process[40,41,42].Superoxide dismutase is an important antioxidant enzyme in the body, which plays an essential role in limiting the harmful effects of ROS, which are reported to have a role in causation of psoriasis. Zinc and copper are an integral part of as many as 40 metalloenzymes, including alkaline phosphatase and superoxide dismutase, and changes in their serum levels may reflect in changes in the activity of these enzymes.

In this case control study we were measured the levels of zinc and copper in serum of Iraqi patients with psoriasis . There was a highly significant decrease of zn.Researchers have noted that psoriatic lesions retain a high content of zinc compared with uninvolved skin suggesting an imbalance in zinc distribution between serum and psoriatic lesions. Exfoliation of large quantities of skin can thus decrease the serum levels of zinc[43]. This has been reflected in some studies showing decreased levels of zinc in patients with severe psoriasis[43,44].

Copper, another important trace metal, in our study we showed a highly significant decreased of its level in serum of Iraqi patients with psoriasis this may be suggest that the serum copper findings in psoriasis merely represent a non-specific response to an inflammatory process, or whether they might be associated with quantitative or qualitative

abnormalities in tissue copper[45].Our study is consisted with this suggestion.

## CONCLUSIONS

1. Psoriatic lesions retain a high content of zinc compared with uninvolved skin suggesting an imbalance in zinc distribution between serum and psoriatic lesions, exfoliation of large quantities of skin can thus decrease the serum levels of zinc.
2. The serum copper findings in psoriasis merely represent a non-specific response to an inflammatory process, or whether they might be associated with quantitative or qualitative abnormalities in tissue copper.
3. There is a possibility that abnormal metabolism of both zinc & copper may also exist in psoriasis.

**Table 1: Groups with Mean ± SD of Age in years**

| Groups | Number | Mean ± SD | P value |
|---|---|---|---|
| Control | 20 | 31.1±17.4 | P > 0.05 |
| Group 2 | 16 | 36 ± 15.5 | P > 0.05 |

**Table 2: Mean ± SD of Zinc & Copper**

| Parameters | Group 1 (n= 20) | Group 2 (n= 16) | P value |
|---|---|---|---|
| Zinc | 1.036 ± 0.16µg/g | 0.068 ± 0.038µg/g | P <0.0001 |
| Copper | 1.042 ± 0.20 µg/g | 0.036 ± 0.019 µg/g | P <0.0001 |

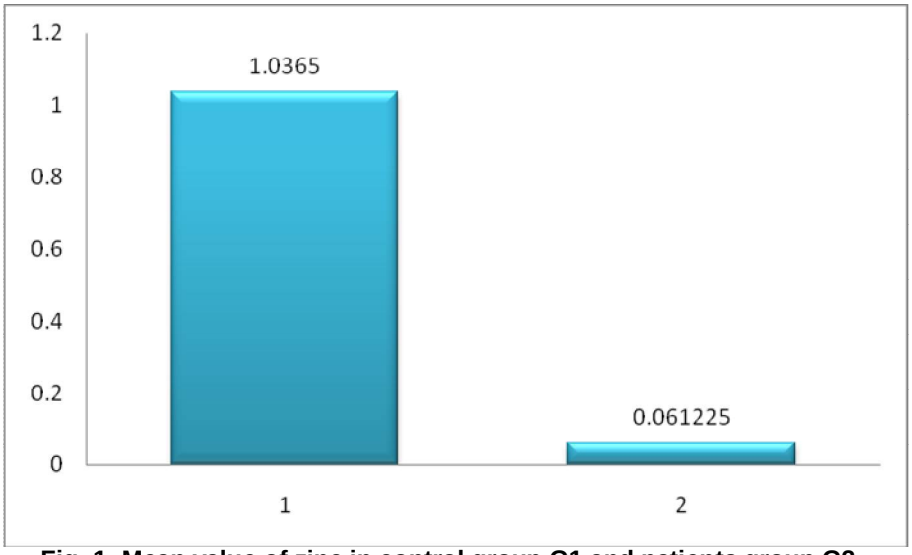


**Fig. 1: Mean value of zinc in control group G1 and patients group G2 . Statistically significant decrease P value < 0,0001**

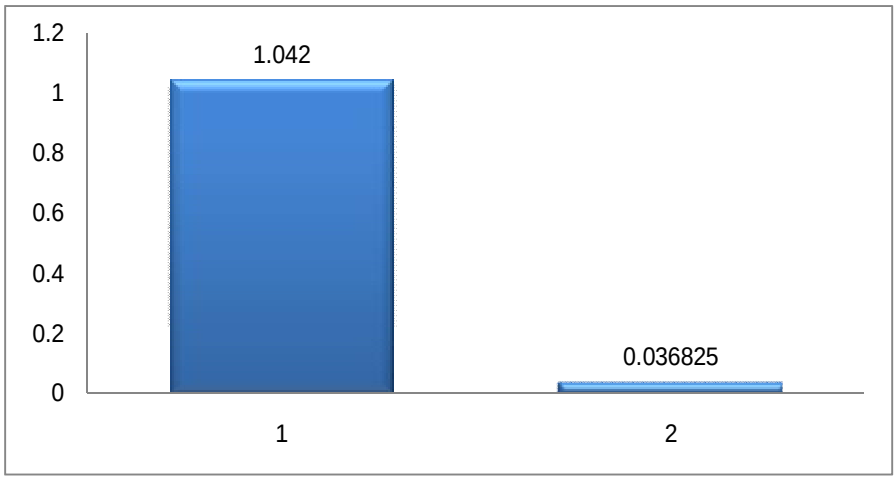


**Fig. 2: Mean value of copper in control group G1 and patients group G2 . Statistically significant decrease P value < 0,0001**

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