

Original Article

Comparison of Serum Zinc and Copper Level in Psoriatic and Non-Psoriatic Individual

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Abstract

Psoriasis is a common chronic inflammatory disease of skin and multiple organs of body. The exact etiology of psoriasis is not yet certain. It is assumed that trace elements may have some role in pathogenesis of psoriasis. They can act as co-enzymes for metabolism and can act as antioxidants against free radicals. Therefore they can participate in epidermal proliferation and inflammatory process of psoriasis. This study aimed to evaluate the relation between psoriasis and trace elements namely zinc and copper. This study was conducted on 40 diagnosed cases of psoriasis and 40 non psoriatic individuals in the department of Dermatology and Venereology in Bangabandhu Sheikh Mujib Medical University, Dhaka. Biochemical analyses of serum copper and zinc were analyzed and compared statistically with cases and healthy controls. Serum zinc level was significantly lower and serum copper level was significantly higher in patient with psoriasis compared to control ($p < 0.001$). Individuals with moderate to severe psoriasis had significantly lower zinc levels and significantly higher copper levels than patients with mild psoriasis, according to Psoriasis area and Severity Index Score ($p < 0.05$). Correction of serum zinc and copper level could be beneficial for psoriasis patients.

Keywords: Psoriasis, serum zinc, serum copper, PASI score

INTRODUCTION

Psoriasis is a multifactorial disease in which certain environmental factors interact with people who have a genetic predisposition to develop immune dysregulation and inappropriate keratinization.¹ The common characteristics of psoriasis is symmetrically involved

erythematous plaques with thick silvery scale. Typical nail changes and joint involvement are also the diagnostic features of psoriasis. There is no specific antigenic factors has been found as causative agents in pathogenesis of this disease.² There are very limited data available on role of zinc and copper in pathogenesis of psoriasis.³

Oxidative stress is one of the important etiological factor that may initiate psoriasis. Antioxidant systems have been found to be significantly impaired in the blood and lesions of psoriatic patients.⁴ An deficient antioxidant system has been linked to elevated levels of reactive oxygen species (ROS) in the pathophysiology of this disease. Deficiency of trace metals like zinc and copper can cause oxidative stress. Trace elements regulate enzymatic activity of keratinocytes and an imbalance in trace elements causes changes in enzymatically dependent keratinization.⁵

In human body zinc is the second most common trace element after iron. Structure stability is assured by zinc protein binding in some enzymes, such as Copper and Zinc superoxide dismutase and catalytic activity is provided by the active copper site.⁶

Copper (Cu) is linked to several metalloproteins. Superoxide dismutase, a copper-containing metalloenzyme, protects against free radical damage. SODs are copper and zinc containing enzymes that convert super oxide radical to peroxide which can be removed subsequently by catalase and other antioxidant defenses. Ceruloplasmin, a plasma protein, binds to copper ions and protects cells from oxidative damage caused by free copper ions, which produce hydroxyl radicals.⁶

There is no comprehensive study of trace elements estimation in Psoriasis in Bangladesh. In the present study, serum zinc & copper levels were analyzed & their relationship with the severity of psoriasis was assessed.

MATERIALS AND METHODS

From July 2018 to June 2019, a cross sectional study was conducted at the department of Dermatology & Venereology, Bangabandhu Sheikh Mujib medical University, Dhaka. For this study 40 diagnosed case of psoriasis age range 18 to 70 years were selected as cases & 40 non psoriatic individuals were selected as controls from the outpatient department of BSMMU, Dhaka. Patients

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who had other skin disorders, cardiac & metabolic problems, liver and renal diseases, pregnant and lactating mother were excluded from this study.

After the study subjects were selected, the study's goals, objectives, risks, benefits were explained to the patients. After taking the informed written consent the participants' personal & medical histories were recorded thoroughly.

Under all aseptic precaution 5 ml blood sample was collected from study subjects. Serum zinc & copper was assessed by colorimetric method in Stat Fax 3300 semi-autoanalyzer. The severity of the disease was assessed by a dermatologist on the basis of psoriasis area and severity index (PASI) score.

Reference value of serum zinc concentration is 80-120 µg/dl & serum copper is 70-140 µg/dl.⁶ Participants who had zinc level < 80 µg/dl were considered as zinc deficient patients & who

had copper level > 140 were considered as patients with high copper level. Depending on PASI score the cases are divided in two groups. Patients with PASI score < 10 (mild psoriasis) were considered as group I and patients with PASI score > 10 (moderate to severe psoriasis) were considered as group II.

All data were collected, preserved and analyzed statistically by using IBM SPSS (version 20). The level of significance for quantitative data was determined using an independent student's t test. The level of significance of qualitative data was expressed as frequency and percentage and analyzed by chi-square test.

RESULTS

Table-I showed that 50% of the cases were male and 50% were female, whereas 47.5% of controls were male and rests were female. Age, weight, height, BMI & family history of study subjects were indifferent statistically.

Table I: Demographic profile of study group (n=80)

| Variables | | Case (n=40) Mean ± SD | Control (n=40) Mean ± SD | p- value |
|----------------------------------|-----------|--------------------------|-----------------------------|----------------------|
| Gender | • Male | 20 (50%) | 19 (47.5%) | |
| | • Female | 20 (50%) | 21 (52.5%) | |
| Age of the respondent | | 38.6 ± 10.6 | 40.4 ± 10.4 | |
| Duration of psoriasis (in year) | | 3.8 ± 1.8 | - | > 0.05 ^{ns} |
| Weight of the respondent (in Kg) | | 58.1 ± 7.1 | 58.3 ± 5.8 | |
| Height of the respondent (in cm) | | 163 ± 3.8 | 164.3 ± 3.3 | |
| BMI of the respondent (kg/sqm) | | 21.8 ± 2.2 | 21.6 ± 1.9 | |
| Family history of psoriasis | • Present | 7 | 2 | |
| | • Absent | 33 | 38 | |

Data was expressed as mean ± SD and comparison between groups was done by Student's t test. Qualitative data was analyzed by Chi-square test to compare among the groups. n= number of subjects, p-value < 0.05 is significant, ns= not significant.

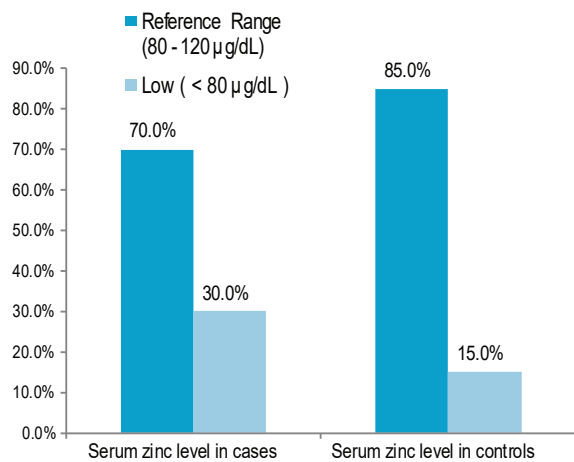


Fig-1: Among the total participants 30.0% and 15.0% had zinc deficiency in cases and controls respectively as shown in

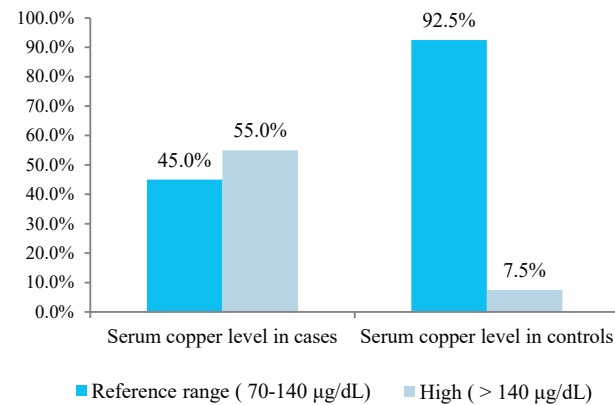


Fig.-2: Among the total participants 55.0% and 7.5% had high level of copper in cases and controls respectively as shown in

Table –II shows the mean values of zinc & copper in both cases & controls. Mean value of serum zinc in psoriasis is significantly low ($66.9 \pm 12.4 \mu\text{g/dL}$) compared to controls, which was significant ($p < 0.001$). Mean value of serum copper in psoriasis is significantly high ($142.9 \pm 29.5 \mu\text{g/dL}$) compared to controls, which was also significant ($p < 0.001$). Table –II also showed that serum zinc is significantly lower & serum copper is significantly higher in patients of group-II compared to group-I.

Table-II: Comparison of serum zinc & copper level in study population (n=80) and their relationship with PASI Score in cases (n=40)

| Variable | | Serum Zinc ($\mu\text{g/dL}$) | Serum Copper ($\mu\text{g/dL}$) | p- value |
|-------------------------------|-----------------------------------|---------------------------------|-----------------------------------|-----------|
| Study Subjects | Case | 66.9 ± 12.4 | 142.9 ± 29.5 | < 0.001 |
| | Control | 85.7 ± 11.9 | 121.2 ± 18.2 | |
| Group according to PASI Score | Group: I (PASI Score < 10) | 70.9 ± 13.1 | 130.7 ± 25.7 | < 0.05 |
| | Group :II (PASI Score > 10) | 63.1 ± 10.6 | 155.1 ± 28.4 | |

Data was expressed as mean \pm SD and comparison between groups was done by Student's t test. n= number of subjects, p-value < 0.05 is significant, ns= not significant.

DISCUSSION

Zinc (Zn) is an essential trace metal for synthesis of protein, activity of various enzymes and removal of free radicals from our body.^{7,8} Zn also helps in the formation of structural proteins during the keratinization process.⁹ In our study we found that serum zinc level was significantly lower in patients with psoriasis compared to controls. This result is consistent with the study of other researchers.^{3,10-12} In contrast to our findings, Butnaru et al.¹³ found that serum Zn levels were higher in psoriasis patients. However, some researchers did not find any significant changes in serum Zn levels in patients with psoriasis compared with healthy controls.^{8,14,15}

Zn is a constituent of DNA and RNA polymerases enzymes. These enzymes are needed for protein synthesis in the affected skin. Low level of zinc in psoriasis may found due to decrease serum protein or albumin which may occur as a consequence of the removal of a large quantity of scales from the body surface.¹¹

In our study we also found that serum zinc level was significantly low in patients with moderate to severe psoriasis than in patients with mild psoriasis. Keratinocyte exfoliation increases in people with severe psoriasis, perhaps leading to more severe skin lesions. Immune dysfunction and decrease antioxidant activity are also found in patients having low serum zinc level and these patients are more vulnerable to viruses and bacterial

infections which can lead to abnormal skin changes and trigger psoriasis. So oral Zn supplementation could be used as a psoriasis adjuvant therapy.¹⁶

In this study, serum copper levels in psoriasis patients were found higher than in controls. This result is consistent with the study of other researchers.^{3,8,11,17} Some researchers found low levels of copper in their investigations, which contradicts our findings.^{10,18} We also found that serum copper was significantly higher in patients with moderate to severe psoriasis than in patients with mild psoriasis which is in accordance to other studies.^{19,20} These inconsistent results may arise from different study designs. Serum Cu is primarily bound to ceruloplasmin which is a multifunctional enzyme that helps to keep Cu levels normal in serum.^{8,11} Ceruloplasmin has recently been discovered to be an acute inflammatory response protein that may scavenge free radicals.^{21,22} As psoriasis is a chronic inflammatory skin disease that has a higher level of oxidative stress so ceruloplasmin activity is increased.¹¹ The levels of ceruloplasmin and serum Cu are positively correlated.²¹ So, high serum Cu levels might be found in psoriasis patients due to elevated ceruloplasmin levels. Our study only included a small number of population and more research with larger number of patients is needed to prove the involvement of trace elements in the pathogenesis of psoriasis.

CONCLUSIONS

According to the findings of this study patients with psoriasis have a lower serum zinc level & greater serum copper level compared to control. Serum copper and zinc levels are correlated to the Psoriasis Area Severity Index which can be used as a marker for determining disease severity. Correction of trace element imbalances may improve in psoriasis treatment and outcome.

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