

Analysis of Serum Zinc and Copper Levels in Alopecia Areata

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Background: As co-factors of metalloenzymes, zinc(Zn) and copper(Cu) have a considerable effect on nearly all the metabolism that takes place in organs of the body, including the skin.

Objective: The purpose of this study was to evaluate zinc and copper status in alopecia areata patients.

Methods: We measured serum levels of zinc and copper in 30 cases of alopecia areata patients and 10 normal individuals by atomic absorption spectrometry. Furthermore, we studied the significance of the ratio between serum levels of the two metals.

Results: The serum levels of zinc were significantly lower in alopecia areata patients than in healthy controls. The serum levels of copper were slightly lower in alopecia areata patients than in healthy controls. Ratios of Cu/Zn were slightly higher in alopecia areata patients than in healthy controls. But their differences were not statistically significant.

Conclusion: We suggest that a serum Zn assay should be included in the chemical assessment of patients with alopecia areata. (Ann Dermatol 9:(4):239-241, 1997).

Key Words : Alopecia areata, Serum copper, Serum zinc

The effects of pathologic conditions on the levels of serum zinc and copper have been of interest to investigators for a number of years. From time to time attempts have been made to determine these trace metal levels associated with diagnoses of interest, but most of those studied were limited in scope, often resulting in conflicting reports. As co-factors of metalloenzymes, zinc and copper have a considerable effect on nearly all the metabolism that takes place in organs of the body, including the skin. In fact, congenital and acquired zinc deficiencies express as a variety of skin manifestations such as psoriasis-like eruptions, blisters, loss of hair, and onychopathy¹. Wilson's disease, Menkes kinky hair disease and Ehlers-Danlos syndrome which are caused by abnormal Cu metabolism,

elicit hyperpigmentation, morphological changes of the hair and lax skin, respectively². These various symptoms suggest the possibility that abnormal metabolism of both metals may also exist in other diseases with similar skin lesions.

In the present study, we examined the serum levels of Zn and Cu in patients with alopecia areata. Furthermore, we studied the significance of the ratio between serum levels of the two metals. Generally, they have a reciprocal activity in metal metabolism

MATERIALS AND METHODS

Materials

Thirty alopecia areata patients and 10 normal individuals were enrolled for this study. All these patients had alopecia areata for at least 6 months before visiting our department for treatment. There were 16 female patients(age; 26.9 ± 8.3) and 14 male patients(age; 26.9 ± 10.7). As test materials, sera obtained from 30 alopecia areata patients were used. As controls, blood was collected from 10 normal individuals(32.5 ± 12.3 years of age).

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Table 1. serum levels of Cu and Zn in alopecia areata

| | No of case | Serum concentrations | | |
|----------|------------|----------------------|----------------------|------------|
| | | Cu | Zn | Cu/Zn |
| Controls | 10 | 94.5 ± 12.2 (ng/dl) | 88.6 ± 8.4 (ng/dl) | 1.05 ± 0.2 |
| Alopecia | 30 | 92.3 ± 16.3 (ng/dl) | 78.8 ± 14.2 (ng/dl)* | 1.06 ± 0.2 |

a: data shown are the mean ± S.D.

b: Statistically significant difference (* < 0.05) compared with controls by student's t-test

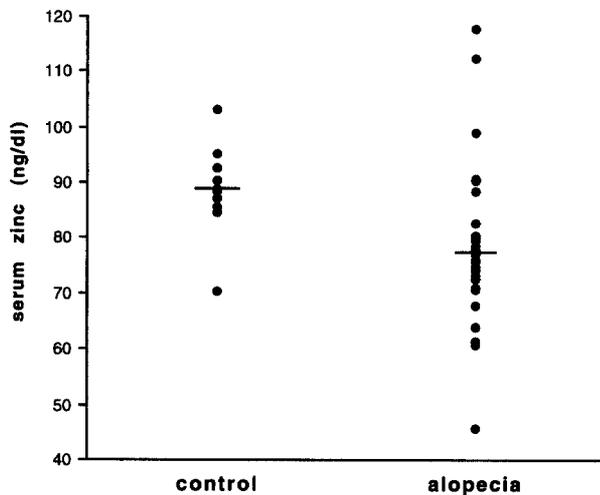


Fig. 1. Scatterplot of serum zinc levels in control and alopecia areata groups.

METHODS

serum copper and zinc by atomic absorption spectrometry

To measure the serum level of Cu, collect blood in a disposable plastic syringe and transfer to a 5mL plastic tube. Allow to clot, centrifuge and transfer 0.5mL serum to a 15mL plastic centrifuge tube. Also transfer 0.5mL volumes of the serum standards to similar tube. Dilute serum and appropriate standards to 5mL with 0.1mol/L HCl and vortex. Use 0.1mol/L HCl as a reagent blank. Aspirate distilled/deionized water into the flame for 20 seconds, followed by the reagent blank for 20 seconds. Repeat this operation 5 times. Perform a similar cycle but replace the reagent blank with the low standard solution. Repeat these cycles using standards of increasing concentration and finally the unknown. Average the 5 readings for each sample. Calculation is based on a response factor de-

rived from a standard curve. The value for the reagent blank should be subtracted from the standard and unknown readings prior to preparation of the curve.

To measure the serum level of Zn, serum sample preparation consisted of a 10-folded dilution with distilled water. Aspirate each diluted specimen into the flame of the atomic absorption spectrometer and measure the absorption. Subtract the value of a reagent blank.

statistical analysis

Student's t-test was used, and the data was expressed as mean ± S.D.

RESULTS

Serum Zn and Cu levels obtained from normal individuals and alopecia areata patients are shown in Table 1. and Fig. 1. The serum levels of Zn were significantly lower in alopecia areata than in the healthy controls. Their differences were statistically significant. The serum levels of Cu were slightly lower in alopecia areata patients than in healthy controls. Ratios of Cu/Zn were slightly higher in alopecia areata patients than in healthy controls. But their differences were not statistically significant.

DISCUSSION

The measurement of serum zinc in alopecia areata has resulted in conflicting data, both reduced² and normal levels being reported³. The present study showed a significantly low level of Zn in alopecia areata patients. This is consistent with the findings of a reduced level of serum Zn in 33 alopecia areata patients² but is at variance with the normal level of serum Zn found in 27 alopecia patients³. The pathogenesis of this reduced serum Zn

level is unknown. Several reports have demonstrated that oral administration of Zn compounds improved hair loss^{4,5}. It has been suggested that a possible reason for the conflicting findings of serum zinc levels in alopecia areata may be due to the failure to take into account the extent of hair involvement, and a relationship between surface area involvement and serum zinc levels in alopecia areata has been reported², but Mussalo-Rauhamaa³ et al did not demonstrate such an effect in alopecia areata.

The role of copper in skin disease⁶ has been widely investigated, particularly with regard to atopic dermatitis⁷⁻⁹. The present study showed that the serum levels of Cu were slightly lower in alopecia areata patients than in healthy controls and ratios of Cu/Zn were slightly higher in alopecia areata patients than in healthy controls. But their differences were not statistically significant.

Copper is required for a variety of functions, including bone formation, proper cardiac function, connective tissue development, myelination of the spinal cord, keratinization, and tissue pigmentation. Zinc has important roles in bone formation, cell-mediated immunity, generalized host defense, and a wide variety of factors related to tissue growth. The multiplicity of functions in which copper and zinc are involved is clearly due to the role this metal plays in specific metalloenzyme systems. The function of copper in metalloenzymes involves electron transfer and enzymatic binding of molecular oxygen. Examples of copper metalloenzymes are superoxide dismutase and lysyl oxidase. Zinc provides structural integrity to the enzyme and/or participates directly in catalysis. Examples of zinc metalloenzymes include DNA and RNA nucleotidyl transferases; alcohol dehydrogenase; glutamic, lactic, and malic dehydrogenase; and δ -aminolevulinic acid dehydratase¹⁰.

Serum concentrations of copper and zinc are influenced by such factors as infections and trauma. Therefore we question the validity of basing conclusions on serum estimations alone. Unless correlated with tissue levels, they give no precise evidence of the copper and zinc status in the body. For example, low serum levels of zinc might indeed be interpreted as evidence of deficiency, and therapists might even be tempted to augment the diet in an effort to correct such 'deficiency'. Wilson

disease, in which the ceruloplasmin-bound copper is markedly diminished while tissue-copper levels are greatly increased, provides an excellent example of this pitfall¹⁰.

This investigation has been designed purely to give accurate estimations of the levels of serum copper and zinc and the ratios of copper/zinc in alopecia areata patients. We suggest that a serum Zn assay should be included in the chemical assessment of patients with alopecia areata.

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