

# Trace element levels in alopecia areata

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## ABSTRACT

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**Background:** Alopecia areata (AA) is a recurrent, nonscarring type of hair loss considered to be an autoimmune process. Though its etiopathology is not fully understood, there are claims that imbalance of trace elements may trigger the onset of AA. **Aim:** The aim of the present study was to assess the levels of zinc, copper, and magnesium in the serum of AA patients. **Methods:** Fifty AA patients (34 men and 16 women), and fifty age and sex matched healthy control subjects were studied. Samples were analyzed using atomic absorption spectrometric methods. **Results:** Serum zinc levels were significantly decreased ( $P < 0.05$ ) in AA patients whose disease was extensive, prolonged, and resistant to treatment, whereas serum copper and magnesium levels showed insignificant rise compared to controls. **Conclusion:** We conclude that copper and magnesium levels are not altered in AA, but the decreased zinc levels found in our study may merit further investigation of the relationship.

**Key words:** Alopecia areata, Copper, Magnesium, Zinc

## INTRODUCTION

Alopecia areata (AA) is a recurrent, nonscarring type of hair loss that can affect any hair bearing area. The incidence of AA is 1–2%. The pathophysiology of AA is considered to be T-cell mediated autoimmunity that occurs mostly in genetically predisposed individuals.<sup>[1]</sup> In addition to disturbance of immune function, complex interactions between predisposing genetic and environmental factors act as triggers for disease progression.<sup>[2]</sup> Also, perifollicular nerves and vasculature, viruses, trace element alterations,<sup>[3]</sup> endocrine disorders, and thyroid dysfunction<sup>[4]</sup> have been hypothesized. There are claims that imbalance of trace elements may trigger the onset of AA. Clinically, AA can present with many different patterns. A flat alopecic plaque with normal skin color, involving the scalp or any other pilar region of the body is the characteristic lesion of AA.<sup>[5]</sup>

## METHODS

The prospective study was conducted in departments of Dermatology and Biochemistry, SKIMS Medical College Hospital, Srinagar. The study population consisted of 50 AA patients attending dermatology OPD. Patients were selected after obtaining written informed consent.

Clearance was obtained from the institutional ethical committee. Detailed history was recorded and clinical examination performed. A proper history in relation to age, sex, residence, socioeconomic status, onset, progression, and treatment was taken. Patients were thoroughly examined with respect to site, number of patches, size of patches, and presence of exclamation point hairs. Also, the mucous membranes and nails were examined to find any associated changes. Severity of alopecia was assessed by the number and size of patches, duration, and area of involvement. Those patients with systemic disease, history of atopy, family history of alopecia, patients currently taking nutritional supplements, magnesium containing laxatives, alcohol, and diuretics were excluded from the study. Fifty age and sex matched healthy subjects, having no skin or systemic disease, were recruited as controls from volunteer hospital employees and attendants of the patients after taking written consent from them.

Five milliliters of venous blood was collected in heparinized metal-free polypropylene tubes in the fasting state from all subjects. Samples were centrifuged at 1500 g for 10 minutes to separate the plasma that was diluted with an equal volume of 20% TCA to precipitate the proteins. The supernatant was then

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directly aspirated into GBC 902 double beam atomic absorption spectrophotometer for zinc and copper measurements. For magnesium, plasma was diluted 1:200 with distilled water and the diluted sample was aspirated into atomic absorption spectrophotometer for analysis. Analytical reliability was determined by analyzing quality control sera obtained from Randox lab Ardmore, UK. The values were presented as mean. Students 't' test was applied for data analysis. The *P* value of <0.05 was considered to be statistically significant.

## RESULTS

Among the 50 AA patients – 34 (68%) men and 16 (32%) women, age range 6–60 years, and mean age 27.3 years – majority of the patients were in the third decade of life [Table 1]. The rural–urban distribution was 22:28 and most of these patients belonged to middle socioeconomic class. The duration of hair loss varied from seven days to 120 months, with prolonged duration in the patients having extensive lesions. Onset of the lesions was sudden in majority of the patients, followed by slow progression, and two patients had recurrent lesions after complete remission. About 50% of the patients had used some treatment in the form of topical or intralesional steroids. Two patients had alopecia totalis, one had alopecia universalis, and six had extensive alopecia. The clinical profile of alopecia lesions is shown in Table 2. Two patients had alopecia totalis, five reticular-type alopecia, one

diffuse alopecia, and one alopecia universalis, all these patients had decreased zinc levels. These patients also had prolonged duration of lesions and resistance to various treatment modalities. The number as well as size of the lesions varied. Exclamation point hairs were present in 15 patients and nail involvement in the form of pitting was seen in five patients. None of the patients had any mucosal or skin lesions besides alopecia.

The mean of serum zinc levels in AA patients and controls were  $78 \pm 7.45 \mu\text{g/dl}$  and  $88 \pm 8.78 \mu\text{g/dl}$ , respectively. The standard error of difference between two means was found using students 't' test. This difference in mean of serum zinc levels was found to be significant ( $P < 0.05$ ). The mean of serum copper levels in study and control groups were  $114 \pm 17.5 \mu\text{g/dl}$  and  $112 \pm 17.02 \mu\text{g/dl}$ , respectively; the difference was statistically insignificant. The mean of serum magnesium levels in the study and control groups were  $1.79 \pm 0.34 \text{ mg/dl}$  and  $1.67 \pm 0.31 \text{ mg/dl}$ , respectively; and the difference was not significant [Table 3]. The decreased levels of zinc were seen in those patients of AA with prolonged duration, extensive lesions, and resistance to treatment.

## DISCUSSION

AA affects 1-2% of general population, age of onset varying from birth to 80 years with equal sex predisposition.<sup>[6]</sup> Our study showed an increased incidence of AA in men compared to women (34:16), and majority of the patients were below 40 years of age which is comparable to the study of Sharma *et al.*<sup>[7]</sup> Complex interactions between predisposing genetic and environmental factors likely play a role in the induction of immune-mediated responses in AA.<sup>[8]</sup> Iron and zinc are the well-known trace elements that are associated with hair shedding.<sup>[9]</sup> Mussalo Rauhama *et al.*<sup>[3]</sup> did not find any difference in serum trace element concentrations of alopecia patients compared to the normal population, but showed a statistically significant difference between the copper content of serum in AA and alopecia universalis patients. Naginiene *et al.*<sup>[4]</sup> found a lower level of zinc in blood and urine of children with alopecia and increased levels of copper and chromium concentrations in their hair compared to healthy individuals. Bruske and Salfeld<sup>[10]</sup> interpreted the statistical association of blood and serum levels of zinc, magnesium, and copper in patients with many dermatological disorders including

Table 1: Age and sex distribution

Age range (years)	Men	Women	Total
1–10	2	1	3
11–20	3	7	10
21–30	17	6	23
31–40	9	1	10
41–50	2	1	3
>50	1	0	1

Table 2: Clinical profile of alopecia areata

Pattern	Number	Exclamation mark hairs	Nail changes
Unifocal	21	13	-
Multifocal	16	2	1
Ophiasic	3	-	1
Alopecia totalis	2	-	2
Alopecia universalis	1	-	-
Saisaifo	1	-	-
Reticular	5	-	1
Diffuse	1	-	-

**Table 3: Comparison of mean serum trace element levels in alopecia patients and healthy controls**

Serum trace element	Cases	Controls	P-value
Zinc ( $\mu\text{g/ml}$ )	78 $\pm$ 7.45	88 $\pm$ 8.78	<0.05
Copper ( $\mu\text{g/ml}$ )	114 $\pm$ 17.5	112 $\pm$ 17.02	>0.05
Magnesium ( $\text{mg/ml}$ )	1.79 $\pm$ 0.34	1.67 $\pm$ 0.31	>0.05

AA and after comparing with healthy people did not find any change in serum levels of zinc and copper, but found a significantly higher level of magnesium. The varied results of the levels of magnesium, copper, and zinc in various studies can be explained on the basis of sample size, methodology, and population variation. Our study showed statistically significant lowered levels of zinc in AA patients compared to controls, but no significant change in copper and magnesium levels. Also, the decreased levels of zinc was seen more in those patients with prolonged duration, extensive lesions, and lesions resistant to treatment, but no statistical correlation could be made because of the small number of these patients. Although the difference of mean zinc levels in AA patients and controls is only 10  $\mu\text{g/dl}$ , it can be of quite significant clinical importance since the trace elements act at molecular level and are active at very minute concentrations. The zinc deficiency induced by trace element replacements with heavy metals can cause the onset of alopecia besides other factors.<sup>[4]</sup>

Further clinical studies enrolling a larger number of patients, using more sophisticated techniques, and involving samples of blood, erythrocytes, and hair are needed to better understand the role of these trace elements in AA. Also, exclusive treatment with zinc supplements can be tried in these patients to see the outcome.

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