RESEARCH ARTICLE

Role of zinc in chronic telogen effluvium in serum and hair of patients with alopecia

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Abstract

Objective: To determine the levels of zinc in hair and serum samples of chronic telogen effluvium patients.

Method: The case-control study was conducted at the Dow University of Health Sciences, Karachi, from April 2017 to May 2018, and comprised diagnosed cases of chronic telogen effluvium in group A, and healthy controls matched for age and gender in group B. Hair pull test was done, and level of zinc in hair and serum samples was determined using atomic absorption spectrophotometer. Data was analysed using SPSS 21.

Results: Of the 100 subjects, 50(50%) were in group A; 28(56%) females ad 22(44%) males with mean age 27.46±4.98 years. There were 50(50%) subejcts in group B; 26(52%) males ad 24(48%) females with mean age 28.34±4.92 years ($p>0.05$). Significantly low levels of zinc were observed in serum as well as hair samples in group A compared to group B ($p<0.05$). A positive significant association was observed in the level of zinc in hair with their concentration in the serum of subjects in both the groups ($r=0.310$, $p<0.05$).

Conclusion: Low levels of zinc in hair and serum were found to be associated with chronic telogen effluvium.

Key Words: Chronic telogen effluvium, Zinc, Alopecia, Hair loss

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Introduction

Chronic telogen effluvium (CTE) is characterised by a generalised loss of hair with a sudden onset that results in excessive shedding of hair for a period >6 months.[1] Another feature of this disease is its unstable duration that can last for a number of years. Although the prevalence of CTE is unknown, hair loss affects 25% women in developed countries.[2]

The pathophysiology behind the role of zinc (Zn) in hair loss can further be highlighted by its influence in the hedgehog signalling pathway as this pathway governs hair morphogenesis.[3] Numerous transcription factors utilize Zn as an element of their Zn finger motifs to control hair growth by hedgehog signalling.[4,5] Zn, by inhibiting follicle regression and enhancing follicle recovery, further highlights its importance in the prevention of alopecia.[6]

The deficiency of this vital trace metal is not only prevalent in Pakistani population, but globally as well.[7] Only a handful of studies have been conducted worldwide that have emphasised the association between CTE and Zn deficiency.[8] To the best of our knowledge, no such study has been conducted on Pakistani population. The current study was planned to fill the gap by determining and comparing the levels of Zn in hair and serum samples of CTE patients.

Patients and Methods

The case-control study was conducted at the Dow University of Health Sciences (DUHS), Karachi, from April 2017 to May 2018. After approval from the institutional ethics review board, the sample size was calculated using Open Source Epidemiologic Statistics for Public Health[9] with 95% confidence interval (CI) and 80% power by convenient and consecutive sample technique. The sample was raised from the outpatient department (OPD) of the Dermatology department of Civil Hospital, Karachi (CHK). Those included were CTE patients aged 18-35 years in group A. Healthy controls selected from among DUHS students and faculty members were placed in group B after being matched for age and gender. The hair pull test was positive in group A, and negative in group B. Those with systemic disease who were on regular medications, those who had undergone scalp surgery, were on Zn treatment or having any hormonal abnormality were excluded. .

For the hair pull test, approximately 60 hair strands were pulled gently between thumb, index and middle finger. Falling of at least 10 strands was considered a positive

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result[10]. The test was performed in all the 4 quadrants, including the bi-temporal area.

After taking written informed consent from all the subjects, data was collected using a questionnaire to record history, physical and clinical examination findings.

Hair samples were collected from the nape of neck, cutting hair with stainless steel scissors.[11] Hair sample were cut 3-4cm in length with a weight of 0. 5-1g. The samples were washed with ultra-pure water. The washed hair were treated with methanol and left in ultrasonic bath. They were then dried and placed in desssicator until analysis. Microwave-assisted digestion of samples was done. Further, 3ml venous blood was drawn from all the participants, which was centrifuged and preserved for further analysis.

Both hair and serum Zn samples were analysed using hollow cathode lamps in flame mode in an atomic absorption spectrometer (AAS) (Perkin Elmer Analyst 800, Waltham, MA, United States).

Data was analysed using SPSS 21. Data was expressed as frequencies and percentages or as mean +/- standard deviation, as appropriate. Chi-square, Mann Whitney U and Pearson correlation tests were used. P<0.005 was considered significant.

Results

Of the 100 subjects, 50(50%) were in group A; 28(56%) females ad 22(44%) males with mean age 27.46±4.98 years. There were 50(50%) subejcts in group B; 26(52%) males ad 24(48%) females with mean age 28.34±4.92 years (p>0.05). Overall, there were 51(51%) subjects who were married, while 49(49%) were single (Table 1).

The levels of Zn in hair (Table 2) and serum (Table 3) of CTE patients were significantly decreased than the controls (p<0.05)). Significantly higher levels of Zinc was found in controls compared to the cases (Figure 1). A

Table-1: Demographic characteristics.

Study Variables	Controls (n=50) Frequency (%)	Cases (n=50) Frequency (%)	p-value
Age, Years (Mean ± SD)	28.34 ± 4.92	27.46 ± 4.98	0.502
Gender			
Male	26 (52)	22 (44)	0.423
Female	24 (48)	28 (56)	
Marital Status			
Single	22 (44)	27 (54)	0.317
Married	28 (56)	23 (46)	

SD: Standard deviatio.

Table-2: Inter-group comparison of zinc levels in hair samples.

Parameters Biochemical	Controls (n=50) Mean	SD	Cases (n = 50) Mean	SD	P
Zinc (µg/g)	327. 72	14. 70	153. 02	11. 52	<0. 001

SD: Standard deviation.

Table-3: Intergroup comparison of serum level of zinc.

Parameters Biochemical	Controls (n=50) Mean	SD	Cases (n = 50) Mean	SD	P
Zinc(µg/dl)	81. 13	4. 37	78. 32	2. 55	<0. 001

SD: Standard deviation.

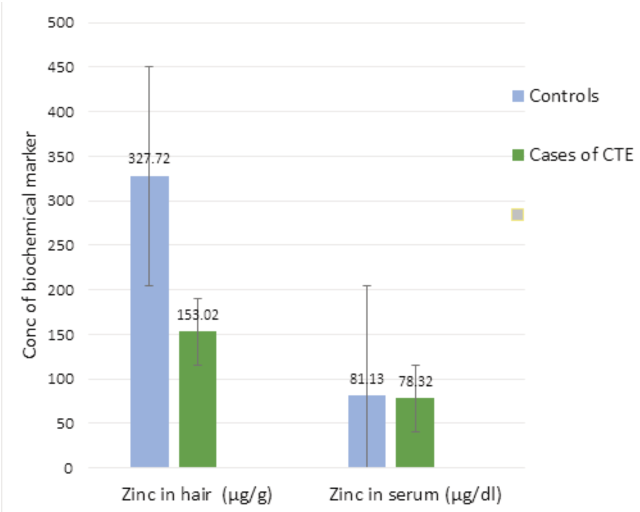

Figure-1: Comparison of xince (Zn) levels in hair and serum of the two groups.
CTE: Chronic telogen effluvium.
Data expressed as mean values.

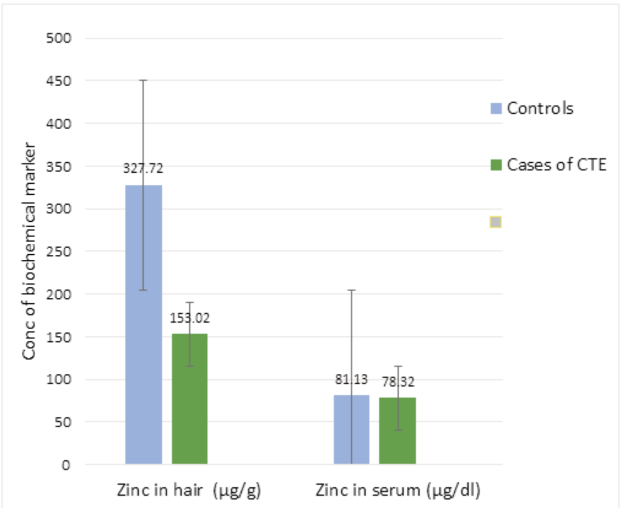

Figure-2: Association of zinc (Zn) level in hair with their concentration in the serum of subjects in the two groups.

positive significant association was observed between Zn level in hair with concentration in the serum in both the groups (r=0.310, $p<0.05$) (Figure 2).

Discussion

Dermatologists are regularly faced with hair problems in their clinical practice.[12] Hair is viewed as one of the most characterising parts of human appearance. Alopecia is a recurring issue that essentially affects personal satisfaction.[13] It has an expected lifetime frequency of 17%.[14]

Zn is the main micronutrient that maintains the health of hair, and prevents hair loss. Previous studies have also explored that Zn deficiency might cause TE, and its supplementation might end the disorder.[15] In the current study, it was observed that levels of Zn were deficient in cases with CTEs, and these results are similar to those of a study done in 2017.[16] The mechanism behind higher hair Zn level is not clearly known. A high-phytate diet may lead to a decreased intake of Zn which leads to a negative influence on Zn status.[17] On the contrary, some other researchers found normal Zn levels in subjects with CTE.[18] Others suggested that CTE alone with no other symptoms or signs of decreased Zn levels is never due to dietary Zn deficiency.[19-21]

Similarly, despite the demonstration of low serum Zn levels in CTE in multiple studies, others have found normal levels. Saito K et al. demonstrated that the difference in the concentration of serum Zn could be due to disturbance in the role of Zn in gene expression, with sex-determining region Y gene-box transcription factor 21 (SOX21) being likely responsible for alopecia in human subjects.[22] Concentration of serum Zn has a role in stabilising the structure of proteins and nucleic acids that is necessary for the proper functioning of all cells, including the hair follicles[22]. Wessels I et al. argued that the main reason behind the association of low serum Zn with hair loss might be because Zn plays an important role in the regulation of gene transcription and translation that maintains the normal structure and functions of proteins and nucleic acids which is essential for the physiological functions of all cells, including the hair follicles.[23] Rajendrasingh JR et al. also observed that Zn deficiency might be linked to the secretion of glucocorticoids that can lead to programmed cell death in the defense mechanism of the immune system, such as lymphocytes, T cells, B cells and thymus, consequently leading to systemic inflammation that can damage not only organs, such as kidneys and liver, but can also affect hair growth, resulting in the defoliation of the hair cycle.[24]

The current study also observed significantly higher levels of Zn in hair compared to serum.

The current study has limitation as it was done at a single centre. Multicentre studies with larger sample sizes are recommended

Conclusion

The levels of Zn in serum were correspondingly reflected in hair. Zn levels were higher in hair compared to serum, indicating that Zn deficiency may contribute to the development of CTE.

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Conflict of Interest: None.

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