Assessment of Serum Levels of some Trace Elements in Alopecia Areata Patients

Thesis

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ABSTRACT

- Alopecia areata is a recurrent, non scaring type of hair loss considered to be an autoimmune process. Though its etiopathogenesis is not fully understood, there are claims that imbalance of trace element may trigger onset of alopecia areata. Objective: To evaluate the levels of zinc, copper, magnesium and iron in serum of AA patients to gain a better understanding of the role of these elements in the disease. Method: Forty AA patients and forty age and sex matched controls were studied. Samples were analysed using atomic absorption spectrophotometric methods. Results: The study showed a significant decline in serum Zinc level in AA patients and increase in serum Copper and Magnesium while no significant difference was found between patient and controls in iron levels. Conclusion: Decreased serum Zn level affects the AA disease negatively, and might be considered as a potential risk factor leading to prolonged disease course with severer disease state.

Key word: Alopecia areata, zinc, copper, iron, magnesium, atomic absorption spectrophotometry**.**

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List of Abbreviations

AA	:	Alopecia areata
Ag	:	Silver
Al	:	Aluminium
AP S-1	:	Autoimmune Polyglandular Syndrome
APCs	:	Antigen Presenting Cells
AS	:	Arsenic
AT	:	Alopecia Totalis
ATP7A	:	Copper transporting P-type adenosine triphosphatase
Au	:	Gold
AU	:	Alopecia Universalis
B	:	Boron
Ba	:	Barium
Be	:	Beryllium
Bi	:	Bisthmus
Ca	:	Cadmium
Cl	:	Chlorine
Co	:	Cobalt
Cr	:	Chromium, F. fluorine
Cs	:	Cesium
CTE	:	Chronic Telogen Effluvium
Cu		Copper
CYA	:	Cyclosporine - A
DIF	:	Direct immune fluorsence
DMT1	:	Divalent Metal transporter 1
DNCB	:	Dinitro chlorobenzene
DPCP	:	Diphencyprone
EFA	:	Essential fatty acids
Fasl	:	Factor of apoptosis signal ligand
Fe	:	Iron
Fe+2	:	Ferric iron
Fe+3	:	Ferrous iron
G-CSF	:	Granulocyte-colony strimulating factor
Ge	:	Germanium
HF	:	Hafnium

HF	:	Hair fallicle
Hg	:	Mercury
HLA	:	Human leukocyte antigen
HMG-COA	:	3 hydroxy 3 methylglutaryl coenzyme A
HPA	:	Hypo thalamic pituitary adrenal axis
I	:	Iodine
ICAM-1	:	Intercellular Adhesion Molecule 1
IGG	:	Immune globulin G
IIF	:	Indirect immune fluorescence
IL-1	:	Interleukin 1
In	:	Indium,
INF-γ	:	Interferon gamma
IP 10	:	Inducible protein
Ir	:	Iridium
IRP1	:	Iron Regulatory Proteins
LFS	:	Low Frequency Sonpohoresis
Li	:	Lithium
MCP 1	:	Monocyte Chemoatt Ractant Protein l
MHC	:	Major Histocompatibility Complex
MICA	:	MHC Class I Chain Related Gene A (MICA).
MIG	:	Monokine Induced by INF-γ
MIP-1a	:	Macrophage Inflammatory Protein 1 Alpha
Mn	:	Manganese
Mo	:	Molebdenum
MOP-8	:	8 Mothoxy Psoralen
MSH	:	Melanocyte Stimulating Hormone
MT	:	Metallothionein
Ni	:	Nickel
NK cells	:	Natural Killer cells
Pb		Lead
PBMC	:	Peripheral Blood Mononuclear Cells
PTP N22	:	Protein Tyrosin Phosphatase, Nonreceptor Type 22
PUVA	:	Psoralen Ultraviolet A
RANTES	:	Regulated On Activation, Normal T Cell Expressed And Secreted
Rb	:	Rubidium

RBCs	:	Red blood Corpuscles
RDA	:	Required Daily Allowance
REES	:	Rare Earth Elements
SADBE	:	Squaric Acid Dibutylester
Sb	:	Antimony
Se	:	Selenium
Si	:	Silica
Sn	:	Tin
Sr	:	Strontium
Ta	:	Tantalum
Te	:	Tellarium
TGF-B1	:	Transforming Growth factor –beta 1
Th1	:	T helper 1
Th2	:	T helper2
Ti	:	Titanium
Ti	:	Titanium
U	:	Uranium
UV	:	Ultraviolet
UVA	:	Ultraviolet A
V	:	Vanadium
Y	:	Yttrium
Zn	:	Zinc
Zr	:	Zirconium

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INTRODUCTION

Alopecia areata (AA) is a non-scaring, autoimmune, inflammatory disease characterized by loss of scalp hair and/or body, the scalp being the most common site affected **(Wasserman et al., 2007)**. Immunologic processes and genetic background play important roles in the pathogenesis of alopecia areata **(Madani and Shapiro, 2000)**. Environmental factors can trigger the disease **(Xiao et al., 2006)**. Subgroups of this disease include those patients with the partial loss of terminal scalp hair (Patchy AA), loss of all terminal scalp hairs (alopecia totalis) (AT) and those patients with total loss of terminal scalp and body hair (alopecia universalis) (AU).

A patch of alopecia usually has a distinctive border where normal hair demarcates the periphery of the lesion. The affected skin appears normal with no epidermal alteration grossly visible such as scaling or follicles **(Wasserman et al., 2007)**.

Hair is composed of proteins, lipids, water and small amounts of trace elements **(Horvath, 2009)**. There are many trace elements in the body, which directly or indirectly participate in metabolism and play key roles in modulating it. Approximately 25% of the enzymes of the human body require metals to be activated and function properly in the metabolism **(Wang et al., 2005)**.

Zinc is an essential trace element for the human organs. It is found in all body tissues with 85% of the whole body zinc in muscle and bones, 11% in the skin and the liver and the remaining in all other tissues

(Tapiero and Tew, 2003). It is known to be an essential component for hair growth and other epidermal tissue **(McDowell, 1992)**.

Copper is a constituent of every tissue and is stored mainly in the liver, brain, heart, kidney and muscles **(Lech and Sadlik, 2007)**. The amount of copper in hair was found to vary both with age and sex of the subject. A positive correlation between hair copper, plasma copper and red blood cell copper was demonstrated **(Klevay, 1970)**.

Magnesium content of the adult human is approximately 24 gm, about half lies in bone and half in soft tissues **(Elin, 1992)**. Magnesium can help bones grow, maintain stable metabolism, keep blood vessels flexible, prevent and provide an antagonist function with Ca **(Wang et al., 2009)**.

Iron is both an essential nutrient and a potential toxicant to cells, as such it requires a highly sophisticated and complex set of regulatory approaches to meet the demands of cells as well as prevent excess accumulation **(Beard, 2001)**. Evidence is reviewed showing that in addition to its importance as an essential nutrient necessary for oxygen metabolism and mitochondrial function, iron exhibits a fundamental importance as a trace element in normal growth and functional maturation of the skin and in health of hair and nails **(Lansdown, 2001)**.

Bhat and colleagues (2009) stated that there are claims that imbalance of trace elements may trigger the onset of alopecia areata. **Bruske and Salfeld (1987)** interpreted the statistic association of blood and serum levels of zinc, magnesium and copper in patients with many dermatological disorders including AA. Also **Wani and Jan (2011)**

found low levels of serum iron in AA patients, while **Esfandiarpour (2008)** found a higher mean level of serum iron in AA patients.

AIM OF WORK

The aim of the work is to evaluate the possible role of various trace elements in triggering alopecia areata by estimating serum levels of the essential trace elements: zinc, copper, magnesium and iron in AA patients and comparing them with normal controls.

CHAPTER I

Hair Follicle

Structure:

Hair follicles comprise a permanent upper segment of follicular infundibulum and isthmus, and an impermanent lower segment of lower follicle and bulb. They cycle continuously through periods of growth and rest, namely anagen and telogen. The lower segment is responsible for generation of the growing hair and disappears during the resting phase. The cylindrical hair fiber is extruded continuously during the growth phase. The hair fiber cortex consists of keratin filaments embedded in a sulfur-rich matrix, enclosing the medulla and surrounded by the cuticle of the hair shaft. It is generated by transient amplifying matrix cells in the hair bulb, which surround the dermal papilla. The hair fiber diameter remains uniform during a single growth phase under normal conditions. The entire hair follicle is enclosed by the outer root sheath or trichilemma, which extends from the hair bulb to the skin surface epidermis lining the infundibulum. The inner root sheath invests the growing hair fiber from bulb to mid-isthmus level (Fig 1) **(Whiting, 2004).**