HAIR COPPER AND ZINC CONCENTRATION IN PREMATURE HAIR GREYING

Thesis

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List of Abbreviations

Abb.	Full term
ACTH	Adrenocorticotropic hormone
AE	Acrodermatitisenteropathica
AGA	Androgenetic alopecia
APM	Arrectorpili muscle
ATP	Adenosine triphosphate
CD4	Cluster of differentiation 4
Co	Cortex
CTS	Connective tissue sheath
Cu	Cuticle
Cu^{+2}	Copper
DNA	Deoxyribonucleic acid
DOPA	3,4-Dihydroxy phenylalanine
DP	Dermal papilla
ER	Endoplasmic reticulum
Fe^{+2}	Ferrous iron
Fe^{+3}	Ferric iron
H_2O_2	Hydrogen peroxide
Hc	Hair cuticle
He	Henle's layer
Hu	Huxley's layer
IL-2	Interleukin-2
IRS	Inner root sheath
K14	Keratin 14
M	Medulla
NK cells	Natural killer cells
NPV	Negative predictive value
O_2	Superoxide radical
ORS	Outer root sheath
PABA	Para-amino benzoic acid

PHA	Phytohemagglutinin
PPV	Positive predictive value
RNA	Ribonucleic acid
ROS	Reactive oxygen species
SG	Sebacious gland
SOD	Superoxide dismutase
TMA	Tissue mineral analysis
TRP-1	Tyrosinase-related protein-1
TRP-2	Tyrosinase-related protein-2
UV	Ultra violet
Zn	Zinc

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Introduction

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raying "or Greying", depigmentation or failure of hair pigmentation has been variously referred to as 'canities', 'achromachia', 'achromotrichia', the condition of absence of pigment from hair or feathers. It is apparently caused by failure of the hair follicles to deposit pigment in the hair at the time the hair is being formed ***(Frost, 1948).***

Although there is no precise definition for the premature canities, it is defined as the occurrence of the hair graying before the age of 20 in whites, 25 in Asians, and 30 in Africans ***(Pandhi and Khanna, 2013).*** It is a genetically determined phenomenon that is usually age related and can be accelerated by some exogenous factors ***(Arck et al., 2006 and Naieni et al., 2011).***

The scalp is subjected to intrinsic or physiologic aging factors and extrinsic or premature aging due to external factors. Intrinsic factors are related to individual genetic and epigenetic mechanisms with interindividual variation. Prototypes are familial premature

graying, and androgenetic alopecia (AGA). Extrinsic factors include ultraviolet radiation, air pollution, smoking, nutrition, and lazy lifestyle. Experimental evidence supports the hypothesis that oxidative stress plays a major role in premature skin and hair aging ***(Trüeb, 2006).***

Premature canities has also been shown to be associated with a cluster of autoimmune disorders such as vitiligo, pernicious anemia, autoimmune thyroid diseases, and some rare premature aging syndromes like Werner's syndrome ***(Naieni et al., 2011).***

Melanocyte aging may be associated with reactive oxygen species-mediated damage to nuclear and mitochondrial DNA with resultant accumulation of mutations with age, in addition to dysregulation of anti-oxidant mechanisms or pro/anti-apoptotic factors within the cells ***(Tobin and Paus, 2001).***

In addition to pigments, lipids and trace elements, proteins mainly compose 65 to 95% of human hair. Most of trace elements don't exist in hair alone, but bind with proteins or fatty acids ***(Tsai et al., 2000).***

Gray hair results when insufficient nutrients are supplied to the scalp to maintain normal

melanin production. Several nutrients are responsible to convert the amino acid tyrosine into melanin. The most common deficiency is with copper (Cu) as grey hair contains much less copper, magnesium (Mg) and calcium (Ca) than naturally coloured hair. While ***Bertazzo et al.*** reported lower concentrations of Cu in white hairs in comparison to black ones and no significant difference in zinc (Zn) concentrations of different hair colors ***(Bertazzo et al., 1996), Allergi et al.*** demonstrated lower concentrations of both Zn and Cu in white hairs ***(Allergi et al., 1990).***

Aim of the Work

he aim of this study was to assess hair zinc and copper concentrations in premature canities.