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ANALYSIS OF TRACE ELEMENT CONTENT IN FINGERNAILS AND HAIR OF A NON INDUSTRIALIZED POPULATION FROM AKOLA DISTRICT.

Zoology

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ABSTRACT

Sampling of human beings for trace element content can be a complex and costly procedure. The use of hair and nails simplifies the process and it is for this reason that such samples are extensively used. It is observed that there exists some positive correlation between element levels in hair and nails, hypertension, and diabetes of these subjects. When studying the relationship of minerals to human health, it becomes increasingly evident that keeping a balance level of minerals in every organ, tissue and cell of the human body may be a prominent key to maintaining a healthy existence.

KEYWORDS

Trace elements, hairs, nails, spectrophotometer.

INTRODUCTION

Much of what is "known" about the biological trace elements is a mixture of improbable fact and plausible nonsense. Over 99% of all animal matter, including the human body is constructed from just 11 elements-hydrogen, oxygen, nitrogen, sodium, potassium, chlorine, sulphur, phosphorus, magnesium, calcium, and carbon-but about half the periodic table is represented in the remaining 0-01%. With greater or lesser certainty about 10 elements have been recognized as essential-copper, iron, zinc, cobalt, iodine, molybdenum, manganese, selenium, chromium, and fluorine-but even this subgroup is heterogenous. Zinc, iron, and copper are built into many enzymes, whereas cobalt is found in only one molecule and iodine too has only one function. The inessential elements include: environmental hazards (lead, mercury, and cadmium); some that are given as drugs (bromine, aluminum, and gold); and popular poisons (arsenic and antimony). The rest seem to be contaminants. What the trace elements have in common is a capacity to enthrall both laymen and scientists. Over 2000 years ago the Greeks burnt sea sponges as a prophylactic against goiter, rightly divining a magic element in the vapor; and as recently as the 1960s a locally common cardiomyopathy was traced to selenium deficiency in central China. Against this background of legend and newsworthiness the analytical advances of the past decades have created new problems as well as new knowledge. Only eight trace elements are generally accepted as being essential for health and wellbeing in higher animals through the consumption of food and beverages; these are cobalt, copper, iodine, iron, manganese, molybdenum, selenium, and zinc. Persuasive evidence has recently appeared that indicates two other trace elements, boron and chromium, may also be essential; however, general acceptance of their essentiality is still lacking. (Weiss D, Whitten B, Leddy D,1972).

The objective of this study was to assess the relationships between lead, cadmium, zinc, and copper and other trace elements contents in fingernails and hair, and the level of environmental exposure in the subjects' places of residence. After hundreds of fingernails and hair analysis, Trace Elements has created a unique system of interpreting nail mineral analysis results. Each test report will provide the clinician with the most complete and comprehensive evaluation and discussion of significant mineral levels, ratios and toxic metals as tested in the fingernails and hair. Included is a listing of individual foods and food groups that the doctor can recommend to eat or avoid in accordance with food allergy indicators and individualized metabolic requirements.

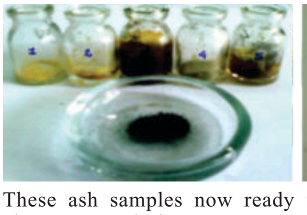
MATERIAL AND METHOD

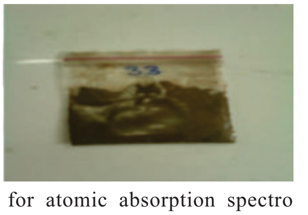
2.1 Sampling Procedure

Contamination of the nail can occure from air, water and nail paints. This type of contamination is removed during sample washing procedure. Nails, particularly toenails, are relatively sheltered from environmental contaminants. They are free from or less likely to have contaminants introduced through shampooing, hair treatments and medication. As for nail polish, the chemicals introduced by polishing can be largely washed out in the laboratory, and the element contents in nails are less likely to be affected. For instance, any external contamination in most nail specimens can be removed using ultrasonic cleaning protocols with both polar and nonpolar solvents. To obtain more nail masses, participants should be asked in advance not to trim their nails for a couple of weeks or longer. Nails are collected by clipping with a stainless steel clipper from the two great toes (or thumbs) and small toes (or other fingers) (Hambidge et al., 1987; Miller et al.,1979).

Contamination of the hair can occur from air, water, perspiration and shampoos. This type of contamination is removed during sample washing procedure. Howere, contamination from dyes, permanents or bleaching of hair cannot be removed. These cosmetic procedure permanently change the structure of the hair and therefore, only natural hair (head, pubic or beard hair) is suitable for hair minerals analysis. Underarm hair is unsuitable for analysis. As hair grows, nutrient and toxic elements are deposited from the blood stream into the hair follicle and hair shaft. Once a trace element has been incorporated into the hair, it remains fixed.

After drying of fingernails and hair samples, add few drops of concentrated nitric acid on the samples which is kept in vials .The procedure is used for the digestion of samples.

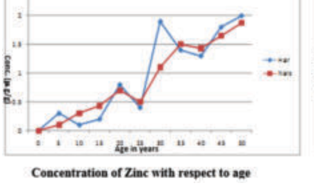




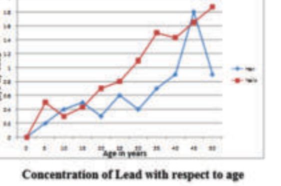
These ash samples now ready for atomic absorption spectro photometer analysis
(Yoshinaga J, Shibata Y, Morita M 1993).

OBSERVATION AND RESULT

Lead and zinc concentrations in hair and nail samples were determined by atomic absorption spectrophotometer (AAS). The mean zinc concentration in hair and nail were 0.743 ± 0.23 mg/g and 0.7820± 0.67 mg/g respectively while the mean lead concentrations in hair and nail were 0.334 ±0.44 and 0.460 ± 0.304 mg/g respectively. A progressive increase in zinc concentrations in hair and nails with age indicated no significant difference when their means were compared suggesting that zinc in hair and nails originate from a common source, comparing the mean lead concentrations in hair with the nails a significant difference is indicated in the 2 tissues (Strain et al., 1972) . Human hair and nails are therefore recording filaments that can reflect metabolic changes of many elements over long periods of time and hence furnish a print out of post nutritional event as dietary levels of some of the essential micro-elements.



Concentration of Zinc with respect to age



Concentration of Lead with respect to age

Summary:-

Elevated zinc in hair is an unusual finding. Occupational or hobbyist exposure to zinc through paints, metalwork, or chemical use can cause elevation. Zinc may be present in detergents and bleaches. Exposure may be related to dermatitis because zinc is a common skin irritant in allergic eczema. Some forms of zinc (i.e., hexavalent) are highly toxic, but acute exposure to such compounds is rare. The high incidence of allergies among the people may in part be related to the presence of zinc in cement. Elevations of hair zinc have been reported only during the special metabolic needs of pregnancy, where the high values were present with evidence of zinc deficiency. Some Indian diets have lead-copper ratios in excess of those that produce hypercholesterolemia. Also, the mortality rate for child was correlated with the ratio of lead to copper in milk in the region. It was found that the abnormal ratio of the trace elements was due to the poor economic condition that was directly affected the diet of the people.

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