Original Research Paper

Biological Science

BIOLOGICAL MONITORING OF TRACE ELEMENTS IN HUMAN HAIR, NAILS AND THEIR APPLICATION AS A BIOMARKERS.

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ABSTRACT A number of tissues in the human body such as the kidney and liver can be used for metal analysis particularly for lead, but these are not easily accessible in living individuals. Specimens readily available for analysis include blood, urine, nails, teeth and hair. Their worth as bio-indicators depends on their capacity to store trace elements. Nails also indicate metal body burden. The presence of toxic and trace elements in biological tissues like hair and nails can be a measure of amount absorbed by a person. Determination of trace elements in human hair is important in biological, medical, environmental and forensic science, as it represents an interesting biological matrix for the studies in both, the inorganic and organic field. Hair is an attractive tissue for analysis, because obtaining a sample is noninvasive and that it is relatively inert. Hair and nails are becoming popular for their utilization as a tool for monitoring environmental pollution or intake of toxic metals. Concentration of metals in hair and nails reflect their mean level in the body during a longer period as compared to body fluids. Sampling of human beings for trace element content can be a complex and costly procedure. The use of hairs 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 elements levels in hair and nails , hypertension ,and diabetes of these subjects. When studying the relationship of minerals in every organ , tissue and cell of the human body may be a prominent key to maintaining a healthy existence.

KEYWORDS : Hair, Nails, Trace Elements, Human Body.

INTRODUCTION:-

Trace elements detection from Hair and nails, trace element assessments in blood, hair and urine specimens have been used in clinical studies. Although comparisons among these markers may not help to determine the accuracy of the measurement of an individual marker since none of them can serve as a gold-standard for others, the measurement in concordance with others may support the capacity of the marker in clinical research. A few studies have been conducted comparing measurements in nail, blood, hair and urine. In general, each of the biomarkers is considered effective for particular clinical studies. However, compared with blood or urine sample, nails particularly toenails provide a relatively long term measure of exposure. Human hair has been accepted as an effective tissue for biological monitoring of toxic heavy metals by the U.S. Environmental Protection Agency and is being used for this purpose throughout the World . It is ideal in that it fits the following criteria.

1) Hair accumulates all the important trace elements.
2) It is a commonly available tissue.
3) It is widespread geographically.
4) Hair is easily collected, stored and transported.
5) It is suitable since specimens can easily be re-sampled.
6) It is present in polluted and non-polluted areas. The objective of this study was to assess the concentration in between lead, cadmium, zinc, and copper and other trace elements contents in head hair, and the level of environmental exposure in the subjects' places of residence. After hundreds of hair analysis, Trace Elements has created a unique system of interpreting hair 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 hair.

METHODOLOGY AND OBSERVATIONS:-

Sampling Procedure

Hair and nails samples was collected from different subject from Akola district from different localities. Samples was collected from different subject with respect to sex, age and living (as well as working) in different environmental condition. Hair samples will be obtained from nape of scalp by cutting 2mm from the scalp with sterilized scissor. The personal and medical histories was obtained through questionnaires. Contamination of the nail can occur from air ,Water and nail paints. This type of contamination was removed during simple washing procedure. Nails, Particularly toenails, are relatively sheltered from environmental contaminants. They are free more or less likely to have contaminants introduced through shampooing, hair treatments and medication. As for nail polish, the chemicals introduced by polishing was largely washed out in the laboratory, and the element contents in nails are less likely to be affected. Samples was washed by non ionic detergent and deionized water (Triton X-100) then both samples was dried in hot air oven at 90^{0}C for 1 hr. Dried samples of hair and nails was digested by using mixture of concentrated nitric acid and perchloric acid. To obtain more nail masses, subject was asked in advance not to cut their nails for a couple of weeks or longer. Analysis of trace elements was done by using atomic absorption spectrophotometer. **(Yoshinaga J, Shibata Y , Morita M 1993).** After obtaining data of trace elements analysis was done.

Fig. :- Hair samples collected

Fig. :- Nails sample collected.

A progressive increase in zinc concentrations in hair with age indicated no significance difference indicated. Our results are in agreement with several other authors who reported varying concentrations of these metals in hair samples. From the zinc levels in nail, it is reasonable to believe that zinc in human tissues may be playing some physiological roles (Vivoli et al., 1990).

Table:- Showing the concentration of trace elements

Sample No. And (Age In Years)	Concentration In Pbb							
	Cr	Cu	Zn	I	Fe	Mn	Cd	Pb
1(21)	203	562	960	703	204	67	20	11
2(45)	112	360	760	813	112	110	32	17
3(27)	304	262	863	790	127	37	11	02
4(45)	412	317	560	803	97	22	55	07
5(11)	167	503	817	619	15	90	50	--
6(54)	234	654	987	456	28	76	32	32
7(46)	241	590	890	413	22	71	29	27
8(48)	109	312	613	503	197	87	60	22
9(10)	432	657	872	768	145	83	45	19
10(29)	569	893	1002	987	90	39	12	05
11(65)	909	904	873	723	61	23	19	02
12(09)	365	893	781	632	89	45	28	18
13(35)	512	734	908	561	21	78	11	09
14(56)	187	564	343	654	11	12	09	--
15(21)	239	368	789	732	23	06	03	--
16(54)	412	872	835	474	13	04	02	--
17(22)	219	321	903	652	54	21	15	05
18(20)	112	874	673	342	21	04	--	--
19(59)	897	654	987	904	45	67	--	--
20(72)	672	874	789	456	77	87	07	--
21(19)	453	654	651	342	34	81	06	--
22(49)	390	637	702	514	12	13	02	02
23(51)	430	718	639	539	47	16	03	02

Elevations of nail zinc have been reported only during the special metabolic needs of pregnancy, where the high values were present with evidence of zinc deficiency. Such a "false" high value in a tissue like hair is not indicative of systemic elevation, but possibly of the system depletion. Inadequate dietary intake or absorption problems may cause zinc deficiency. An imbalance in zinc and copper metabolism contributes to the risk of coronaryheart disease (CHD). Some Indian diets have zinc-copper ratios in excess of those that produce hypercholesterolemia.

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