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COMPARATIVE ANALYSIS OF METALLIC ELEMENTS AMONG MENOPAUSAL, PREGNANT AND UN MARRIED FEMALES BY USING FINGERNAILS

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ABSTRACT
Nails being noninvasive material are good biomarkers of metallic elemental status in human body. Three categories of females viz unmarried, pregnant and menopause were selected for present study. Excess or deficiency of metallic elements among unmarried, pregnant and menopause produce differential effects. Among unmarried ones leads towards menstrual disorders. Pregnant ones are more susceptible in terms of fetus safety, among which they can produce adverse reproductive outcomes. Menopausal can suffer from health disorders due to imbalance of these metals. Knowledge about metallic elements in females body is important in this regard because they are part of whole body machinery and there deficiency, excess or any imbalance leads towards different disorders The metals under consideration were lead, iron, cadmium, chromium, manganese, copper and zinc. Concentration of lead, cadmium and manganese was significantly elevated among menopausal females matched to unmarried and pregnant females. Iron level and copper level were higher among un-married as c compared to other two categories. Pregnant females had elevated level of zinc and chromium.

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INTRODUCTION

Metal determination in human tissues is the most common application of biological monitoring for screening and diagnosis of metal exposures. Nails as biopsy materials are suggested as more attractive biomarkers in assessing heavy metals environmental exposure. They are preferred biological medium because of ease of collection, storage, convenience, their usefulness in estimating intake of minerals in nutritional studies and ease of handling (Daniel *et al*.,2004)

Metal contamination issues are becoming increasingly common because of Industrialization, urbanization, mining operations, increased vehicular traffic, use of fertilizers and pesticides in agriculture. The essential trace elements getting

displaced from the metabolic active sites, by accumulation of toxic trace elements from the working environment. For example chromium is an essential trace element required for normal carbohydrate, lipid, and protein metabolism (Vincent,2004) and normalizes blood sugar levels (Anderson,1980). Chromium can be toxic at higher levels, as found in industrial exposure, causing hepatic per oxidative damage while chromium deficiency depresses nucleic acid synthesis and decreases fertility, also results in impaired glucose tolerance, hyperglycemia, and glycosuria that cannot be controlled with insulin (Anderson,1998; Jeejeebhoy,1999).

The involvement of copper in so many essential biochemical reactions in humans has long been recognized. Copper is required as a cofactor for many enzymes such as cytochrome oxidase(Friberg *et al*.,1986). Copper poisoning frequently associated with suicidal intent include: nausea, vomiting, diarrhea, hypotension, jaundice, hematuria, anuria, coma and death (Chuttani *et al*.,1965).Copper deficiency leads to anaemia defective wool keratinization, abnormal bone formation, arterial and cardiac aneurysm (Hart *et al*.,1928; Shields *et al*.,1965).

Iron cation is crucial for the delivery of oxygen within the body through interactions with hemoglobin and myoglobin. Iron is also the main part of cytochrome C which is responsible for electron transfer within mitochondria. Therefore, a high iron concentration may have an indirect impact on fatty acid oxidation and ATP production in mitochondria (Griffith,1995; Clement,1994).Iron deficiency is common in overweight and obese subjects (Nead *et al*.,2004). Fe deficiency is involved in the pathophysiology of restless legs syndrome (Tan *et al*.,2006) also associated with alterations in many metabolic processes that affects brain functioning, among whom are neurotransmitter metabolism, protein synthesis, organogenesis (Beard,1999).

Present investigation study was carried out in order to determine the concentration of different metals in the nails samples of females, resident of Sargodha district which was categorized on the basis of age and physical condition i.e. pregnant, un married and menopausal.

MATERIAL AND METHOD

Introduction of the study site

Sargodha is the city of Sargodha District, Punjab, Pakistan. It is located in the north-east of Pakistan. It is the eleventh largest city of Pakistan and is known as Pakistan's best citrus-producing area. It is an agricultural trade center with various industries. Pakistan's largest Airbase is situated in Sargodha and known as ‘city of eagles’.

Collection and Analysis of Data:

The questionnaires were filled by face to face conversation regarding marital status, no of children. After it 75 females were selected.

Investigation study was conducted on female individuals residing in Sargodha district. The population under study was categorized on the basis of age and physical condition like unmarried, pregnant and menopause. 25 females who all were healthy with age ranging from 20-35 were included in unmarried group while 25 females who were 3-7 months pregnant were categorized in pregnant group. Menopausal group was consisted of 25 menopausal female (age 40 – 70) all were healthy volunteers.

A weighed quantity of (100 mg) of nails sample was taken in properly washed and labelled Erlenmeyer flask. Acid digestion was carried out by using nitric acid and hydrogen per oxide (Rodushkin and Axelsson,2000). 4ml of nitric acid was added to each sample and incubated it over-night at room temperature. The samples were heated on hot plate, cooled and then 2ml of per-chloric acid was added to them. Then volume up to 25ml was made up with the help of doubled distilled water. After filtering solution was transferred into marked Teflon bottles. After wet acid digestion samples of nails were run through Atomic absorption spectrophotometer (AA 6600 Shimadzu) for determination of Pb, Zn, Fe, Cu, Cr, Cd and Mn.

RESULT AND DISCUSSION

The present investigation exhibits a great variation in metal concentration among pregnant, un married and menopausal females due to some natural factors i.e. climate change and demographic factors. The metals under consideration were lead, iron, cadmium, chromium, manganese, copper and zinc

Cadmium is considered as a toxic heavy metal with no known metabolic function in the body (Lauwerys *et al*.,1994). Cd concentration in nails of females was 0.0042-0.0130 µg/g and highest values were present among Menopause ones (0.0067-0.00112 µg/g) (fig1). Were *et al*.,2008 reported Cd concentration in nails as 0.44±0.06 µg/g and 0.73±0.08 µg/g while according to Mehra and Juneja(2003) the Cd level was 0.321±0.21 µg/g that all are higher than ours. Cd nail concentration in Pregnant ranged from 0.0042-0.0130 µg/g while in Un-married it was observed as 0.00128-0.00212 µg/g.

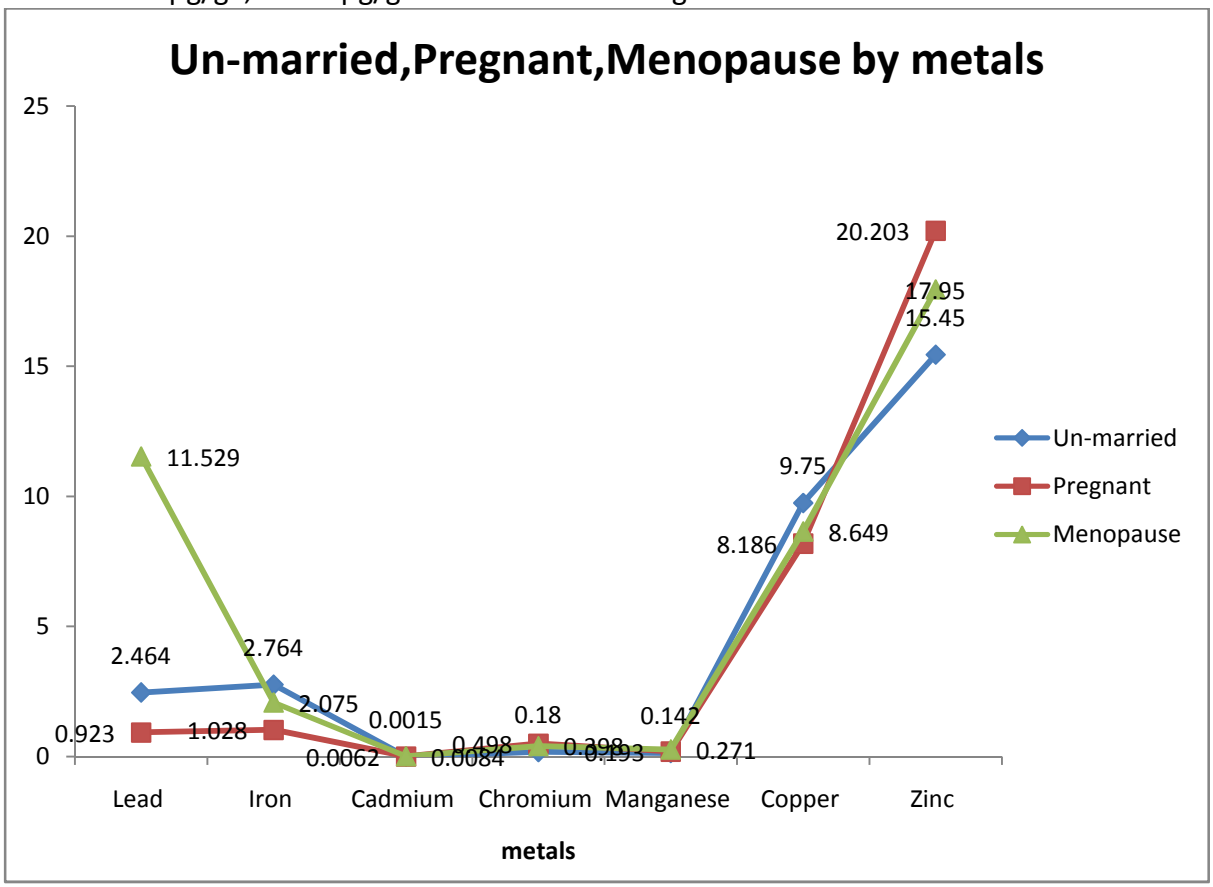
Lead is naturally occurring metal that people have used almost since the beginning of civilization. Concentration of lead in nails samples was recorded as 14.16 ug/g- 0.2 ug/g that are in agreement with Mehra and Juneja,2003who reported its level as 7.60±6.44 µg/g and the highest value of Pb nail concentration was found in menopause females (8.248-14.16 µg/g) while Pb was detected as 1.213-3.48 µg/g for unmarried and 0.21-3.21 µg/g for pregnant ones.

Iron cation is crucial for the delivery of oxygen within the body through interactions with hemoglobin and myoglobin. High iron concentration may have an indirect impact on fatty acid oxidation and ATP production in mitochondria (Griffith,1995; Clement,1994).Mehra and Juneja (2003) reported Fe concentration in nails as 147.18±57.65 µg/g that does not substantiate with our ones (0.304-2.611 µg/g). Fe concentration was found highest among Un-married in range of 2.27-3.116 µg/g while Fe concentration ranged from 0.304 µg/g to 1.545 µg/g in Pregnant and from 1.531 to 2.61 µg/g in Menopausal females.

Minerals	Source of variation	Df	MS	F value
Lead	Un married× pregnant× menopause	2	763.0545	544.5965*
Iron	Un married × pregnant× menopause	2	17.35626	195.456*
Cadmium	Un married× pregnant × menopause	2	0.000317	2.17E-28*
Chromium	Un married × pregnant × menopause	2	0.522911	313.6482*
Manganese	Un married× pregnant× menopause	2	0.206346	17.97309*
Copper	Un married× pregnant× menopause	2	144.2705	2.000352*
Zinc	Un married× pregnant× menopause	2	143.4668	1.016217*

Chromium, in the form of naturally occurring diniocotinic acid-glutathione complex, also known as glucose tolerance factor (GTF), is vital for carbohydrate metabolism as it potentiates the action of insulin (Merz,1982). Statistically significant difference was found among un married vs pregnant vs menopausal females. Cr nail concentration ranged from 0.522-0.3040 µg/g, 0.4844-0.5109 µg/g and 0.3675-0.4276 µg/g of Un-married, Pregnant and Menopause respectively. Were *et al*, 2008worked on nails toxicity and their

finding are as 0.73 µg/g , 0.44 µg/g that is in agreement with our observation.



Manganese is recognized as plying an important role in the functioning of isocitric dehydrogenase, an important control enzyme in the regulation of Krebs Cycle (Harper,1979). In case of nails Mn concentration evaluated by Mehra and Juneja,2003values were as 3.16, 3.81 µg/g and 1.31 µg/g, while our are in the range of 0.054 – 0.2231 µg/g among un married that are lower than that of Mehra and Juneja. The highest peak observed in Menopause for Mn nail concentration was (0.2406-0.3102 µg/g) while 0.1489-0.2231 µg/g concentration was recorded for pregnant ones.

The involvement of copper in so many essential biochemical reactions in humans has long been recognized. Copper is required as a cofactor for many enzymes such as cytochrome oxidase (Friberg *et al.*,1986). Cu nails concentration ranges from 2.955-31.645 µg/g, 7.575-10.705 µg/g and 7.715-14.04 µg/g in Un-married, Pregnant and Menopause so Pregnant shows the highest peak on graph than others. Mehra and Juneja Mehra and Juneja,2003reported 8.48 µg/g Cu in nail samples that is in agreement with our values (7.575 – 14.04 µg/g).

Zinc, one of the important essential trace mineral is required in gene expression and the regulation of cellular growth and differentiation. Zn dependent enzymes are involved in macronutrient metabolism and cell replication(Hays and Swenson,1985; Arinola *et al.*,20080. The ranges of Zn nail concentration in Pregnant, Menopause and Un-married were 9.095-68.54 µg/g, 6.725-34.89 µg/g and 6.68-51.855 µg/g respectively. Pregnant Zn nail concentration value is maximum in our observations.

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