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Research paper

A Study to Determine the Concentration of Lead and Chromium in Human Population of Pithampur industrial region.

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Abstract: The study is conducted in Pithampur Industrial Area of Dhar district (M.P.). The total 70 samples of human waste blood were collected from the government hospital of Pithampur. The concentration of two highly toxic heavy metals lead (Pb) and Chromium (Cr) were determined in human blood plasma by using ICP-MS technique. We have considered four age groups 11–20, 21–30, 31–40 and 41–50 years of industrial workers/local residents. The results of our study showed persistence of both heavy metals, lead and chromium in high concentrations in all the age groups. The highest concentration of lead (Pb) is found in the age group of 31-40 years while as that of chromium (Cr) in the age group of 41-50 years. The highest concentration of both heavy metals indicate more chronic exposure to industrial pollution as these heavy metals accumulate in human bodies and cause several health problems.

Keywords: Plasma, Heavy Metals, Lead (Pb), Chromium (Cr), ICP-MS.

Introduction:

Pithampur is an industrial town in Dhar district of West Madhya Pradesh. It is a largest industrial hub in Central India. Pithampur is located at 22'367N latitude and 75.6964'E longitude and located 22 Km away from Indore city. According to 2011 census, Pithampur has a population of approx. 1.26 lacks. Number of industries directly drain out their untreated effluents in Nahllas near to these industries. These effluents then reach and pollute Gambhir river which is located in Mhow (Town of Indore Distt.), 5 kms away from Pithampur. No study has been done before in Pithampur Industrial area on detection of heavy metal contamination in human population. Our research is based on the study to evaluate concentrations of heavy metals like Pb and Cr in waste blood samples of human population inhabiting the town. These metals are used in number of industries in

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Pithampur for manufacturing PVC pipes, ceramics, corrosion resistant paints, batteries, soldiering, bearings, textile, leather, tanning, dying, electroplating, cable covers, agro, pharmaceutical, plastic goods and dying industries etc.

As reported by earlier workers that when particulate Pb is inhaled, affect lungs and slowly comes in blood circulation, get attached to haemoglobin, deposit in liver, kidney, interfere in cardio-vascular, gastro-intestinal systems etc. (Castro *et al*., 2008; Brochin *et al.,* 2008). Glaser *et al.*, (1985) found in their studies that high doses of hexavalent chromium reduce the phagocytic action of alveolar macrophages and humoral immune response. Extensive uses of chromium compounds in industries and their release as effluents without proper treatment cause blisters and chromium spores in skin of workers/ local people due to dermal contact Cr (VI) inhalation induces hypersensitivity reactions Winder and Carmody (2002). Deng *et al*., (2019) investigated colorectal cancer due to chromium (VI) in mouse model. Zhang *et al.,* in 2011 reported that the Cr concentration in RBC was about two times greater in electroplating workers than in control subjects.

Lead is very quickly absorbed in blood stream and is believed to have adverse effects on certain organ systems like central nervous system, cardiovascular system and immune system (Bergeson, 2008). Burki (2012); Kianoush *et al.*, (2013) reported heavy metal toxicity affecting neurological and cognitive functions of body. Merill *et al*., (2007) noted in their study that in adults about 30 - 40 percent of inhaled Pb dust is deposited in the lungs while 95 percent goes into the blood stream. Toxic nature of lead affects the nervous system when compared to other organ system of human body (Gilani *et al*. 2015).

Not only the workers who spend more time in the industrial areas where high concentration of metal dust or fumes discharge occur, but the population in the vicinities also get affected by pollution. Ferner, (2001) reported that Pb is very toxic and absorbed in the inorganic form through ingestion by food, water and by inhalation.

Material and Methods:

For quantitative detection of Pb and Cr in human population of the industrial area, four age groups: 11-20 years, 21-30 years, 31-40 years and 41-50 years of industrial workers and local residents were considered. The total 70 waste blood samples were collected from govt. hospital of Pithampur and kept in -20°C. Analysis of Pb and Cr were done by ICP-MS technique (Agilent 7700 technologies) and according to the method of Andrejs *et al.,*1996. The study protocol was approved by the Institutional Ethical Committee constituted according to guidelines of ICMR.

Mean and Standard deviations of all 70 samples in each age group were presented in Table -1 and graphical representations in Fig.2

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Figure – 1: Map Showing sampling site (Pithampur industrial Area)

Results and Discussion:

The present report represents the first comprehensive assessment of heavy metals toxicity especially lead and chromium in human blood in relation to different age groups of human population from Pithampur Industrial area. Heavy metal content in human blood is an important way of assessing risk of environmental exposures of toxic metals (Christensen 1995). The mean values of our results show raised concentrations of both Pb and Cr in all blood samples as compared to their reference values given by Heitland and Koster 2006, (Pb - 22 µg/L) and Versieck *et al.*, 1979 (Cr - 0.16 µg/L). Our findings show presence of heavy metals in very wide range in each group considered in our studies (Table -1). These variations indicate the levels of exposures to both the heavy metals and also the probability of adverse consequences to health problems due these hazardous heavy metals. The Pb concentration levels in 11-30 years as well as in 41-50 years showed not much difference in their values found in those groups while much raised concentration of Pb is observed in the age group 31 – 40 years also, with a highest value of 90.06 µg/L. Age group 11 – 20 years showed lowest value of 19.74 µg/L. Though the later value is below the reference value 22 µg/L as referred earlier but its presence in the body indicates the alarming affects as Pb is not at all an essential component for human beings. Earlier studies by number of workers reported the interference of Pb in body metabolism. Ogwuebgu and Muhanga, 2005 also reported that this heavy metal inhibits synthesis of haemoglobin, cause dysfunction of kidneys, joints, reproductive organs, cardiovascular system, acute and also chronic damage of the nervous system. Our previous studies also reported that sub clinical doses of lead affects adoptive immune response (Khanna and Johri, 1991), migration inhibition factor and humoral immunity (Khanna, 2014).

Concentration level of Cr in all 70 samples is higher than its reference value as given in Table1. Our results showed subtle differences in the concentrations of Cr in the age groups 21 to 50 years in their mean values as well as maximum value of near about 5 µg/L in the same age groups. Chromium is said to be the one of the toxic metals. Dermal contact and inhalation of Cr (vi) causes lung cancer, nasal irritation, nasal ulcer, hypersensitivity, chromium pores etc. as reported by Bruynzeel *et al.*,

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(1988); Leroyer *et al.*, (1998). Non-occupational exposure occurs via ingestion of Cr containing food and water in gastro-intestinal tract (Ferner, 2001). Major sources of Cr pollution are due to leather tanning, electroplating, alloy manufacturing, paint and pigment productions. These industrial activities play an important role to Cr pollution and adverse affects on environment (Ghani *et al.*, 2011; Singh *et al.*, 2013).

Table 1: Mean concentration values of Pb and Cr in human blood sample with respect to age groups.

Age groups (Age in Years)	No. of Blood Samples	Range of Persistence of Pb in µg/L	Mean concentration of Pb µg/L	Range of Persistence of Cr in µg/L	Mean concentration of Cr µg/L
11 to 20	09	19.74-70.04	43.691±16.387	1.69-3.47	2.767±0.651
21 to 30	23	21.11-88.18	43.630±18.819	1.03-5.00	3.063±1.181
31 to 40	23	25.7-90.06	50.904±19.137	1.18-5.80	3.344±1.25
41 to 50	15	31.76-86.30	44.459±18.883	2.09-5.00	3.346±0.825

Reference values
Lead-22 µg/L (Heitland and Koster 2006).
Chromium- 0.16 µg/L (Versieck, *et al.*, 1979).

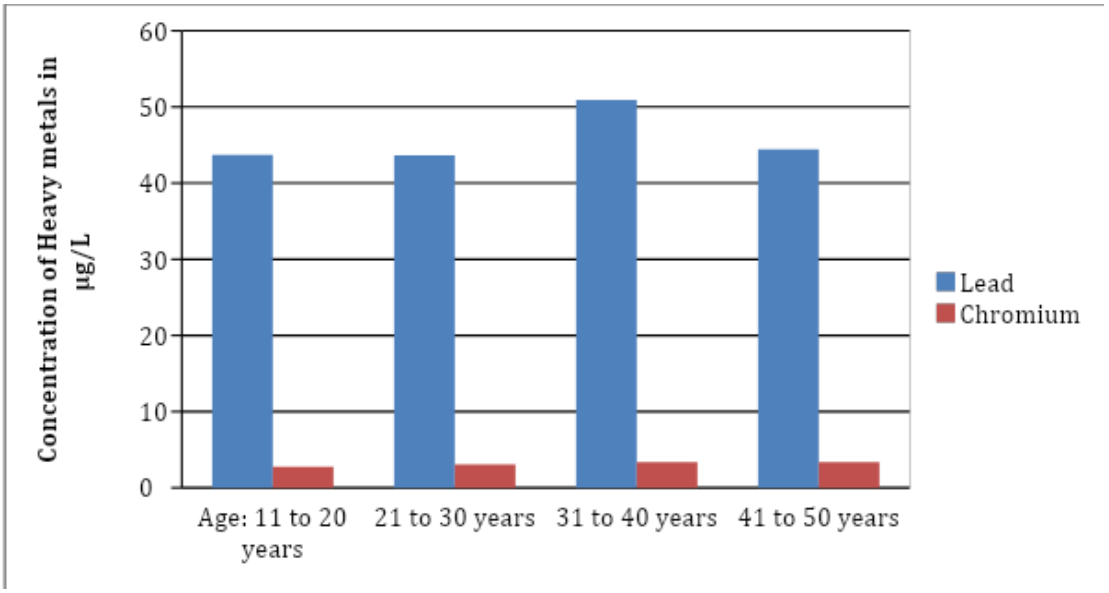

Figure 2- Graphical representation of mean concentrations of Lead and Chromium in collected blood samples.

Conclusion:
Thus, our studies give evidence of risks of environmental pollution in the industrial town Pithampur. Both Pb and Cr showed very high levels of their persistence in human blood samples of workers/

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residents of the town. Our studies also support the findings of Perumal and Thangamani (2011) who also reported heavy metals (Pb,Cr) in human blood due to exposure to industrial environment. Our study also throw light on the level of heavy metal toxicity in different age groups of human population and there by unhygienic living conditions. The study also exposes the negligence of industrial units for their discharge of contaminated effluents in open drains, spoiling the soil and water resources and leading to ecological damage.

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References:
Castro-Gonzalez M. I. and Mendez-Armenta M. (2008) Heavy metals Implications associated to fish consumption, Environmental Toxicology & Pharmacology. 26, 263–271.

Brochin, R., Leone, S.,Phillips, D. Shepard, N., Zisa, D. and Angero, A. (2008) The Cellular Effect of Lead Poisoning and Its Clinical Picture. G. U. Jr. Health Sci. 5 (2)**,** on line 524.

Glaser, U., Hochrainer, D., *Klippel*, H., and Kuhnen, H. (1985) Low level chromium (VI) inhalation effects on alveolar macrophages and immune functions in Wistar rats. Archives of Toxicology 57(4), 250–256.

Winder, C. and Carmody, M. (2002) The dermal toxicity of cement. Toxicology Industrial Health 18(7), 321- 331.

Deng, Y., Wang, M., Tian, T., Lin, S., Xu, P., Zhou, L., Dai, C., Hao, Q., Wu, Y., Zhai, Z., Zhu, Y., Zhuang, G and Dai, Z. (2019) The Effect of Hexavalent Chromium on the Incidence and Mortality of Human Cancers: A Meta-Analysis Based on Published Epidemiological Cohort Studies. Front. Oncol. 9(24) https://doi.org/10.3389/fonc.2019.00024.

Zhang, X. H., Zhang, X., Wang, X. C., Jin, L. F., Yang, Z. P., Jiang, C. X., Chen, Q., Ren, X. B., Cao, J. Z., Wang, Q. and Zhu, Y. M. (2011) Chronic occupational exposure to hexavalent chromium causes DNA damage in electroplating workers. BMC Pub. Health, 11, 224. http://dx.doi.org/10.1186/1471-2458-11-224

Bergeson, L. L. (2008) The proposed lead NAAQS: Is consideration of cost in the clean air act's future?, Environmental Quality Management.; 18,79-84.

Burki, T. K. (2012) Nigeria's lead poisoning crisis could leave a long legacy. Lancet 379 (9818), 792, DOI: 10.1016/s0140-6736(12)60332-8.

Kianoush, S., Balali-mood, M., Mousavi, S. R., Shakeri, M. T., Dadpour, B., Moradi, B., and Sadeghi, M. (2013) Clinical, Toxicological, Biochemical and hematologic parameters in lead exposed workers of a car battery industry. Iran j. Med. Sci 38(1), 30 – 37.

Merill, J. C., Morton J. J. P.,and Soileau, S. D. (2007) Principles and Methods of Toxicology. 5th ed. CRC Press;.

Gilani,S. R., Batool, M., Zaidi, S. R. A., Mahmood, Z., Bhatti, A. A. and Durrani, A. I. (2015) Toxicity caused by metal poisoning: brain as a target organCentral nervous system.Pak. J. Pharm. Sci.(28), 4, 1417-1423.

Ferner, D. J. (2001) Toxicity, Heavy Metals. eMed. J. 2(5), 1.

Andrejs, S., Berdahl, I. A., Ekholm, A., and Skerfving, S. (1996) Measurement by ICP-MS of lead in Plasma and whole blood of lead workers and controls, Occupational and
Environmental Medicine, 53,736-740.

Christensen, J. M. (1995) Human exposure to toxic metals: factors influencing

ISSN: 2348-8344 (Online)
DOI: 10.26540/ijgsr.v10.i2.2023.243

interpretation of bio monitoring results. Sci Total Environ. 166 (1-3),89--35.

Heitland, P., Koster, H. D. (2006) Biomonitoring of 37 trace elements in blood samples from inhabitants of northern Germany by ICP-MS.J Trace Elem Med Biol 20(4), 253–262.

Versieck, J., DeRudder, J., and Barbier, F. (1979) Serum Chromium Level JAMA 242(15), 1613.

Ogwuegbua, M. O. C., and Muhanga, W. (2005) Investigation of Lead Concentration in the Blood of People in the Copperbelt Province of Zambia. Journal of Environment, 1 (1), 66-75.

Khanna, R. and Johri, G. N. (1991) Lead and Immunity: ll Suppression of immune response to H.nana, J. of Hygiene , Epidemiology, Microbiology and Immunology,35 (1),1- 7.

Khanna, R. (2014) Lead Effect on cellular transfer of immune response , migration inhibition factor and Humoral Immunity. Journal of Environmental Research and Development. 8 (3A), 651- 657.

Bruynzeel, D. P., Hennipman, G., and van Ketel, W. G. (1988) Irritant contact dermatitis and chrome-passivated metal. Contact Dermatitis PMID: 2973393 DOI: 10.1111/j.1600-0536.1988.tb02889.x.

Leroyer, C., Dewitte, J. D., Bassanets, A., Boutoux, M., Daniel, C., and Clavier, J. (1998) Occupational Asthma due to Chromium Respiration, 65(5), 403–405.

Ghani, A. (2011) Effect of Chromium toxicity on growth ,chlorophyll and some mineral nutrients of Brassica juncea L. Egyptian Acad. J. Biol. Sci., 2,(1), 9-15.

Singh, N., Verma, T.and Gaur, R. (2013) Detoxification of hexavalent chromium by an indigenous facultative anaerobic Bacillus cereus strain isolated from tannery effluent. Afric J Biotechnol.12(10), 1091-1103.

Perumal, A. S., Thangamani, A. (2011) Atomic absorption spectrophotometric determination of heavy metals lead and chromium levels in human hair of people living in Katpadi and Yelagiri hills of Vellore district. International Journal of Research in Ayurveda & Pharmacy 2(5) , 1568 – 1570.