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Bio-monitering of automobile workers for lead contamination

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Abstract

Widespread use of metals in industrial activities has enhanced the occupational exposure to toxic metals as well as the health risk of metal hazards to human. Elemental analysis in the human tissues is the most common application of biological monitoring of screening, diagnosis and assessment of such exposure and risk. Among various biopsy materials, Blood, nails, hair, teeth and body fluids may be used as bio indicators for this purpose. The present paper includes the quantitative determination(by atomic absorption spectrophotometer/AAS)for lead metal concentration in blood samples of persons who are working in garages and automobile workshops and this increased level of lead in humans cause so many health problems like kidney disorder or failure, anaemia and some times hypertension, water borne diseases.

Key-Words: AAS, health problem, blood analysis, occupational exposure

Introduction

Blood is the liquid life of living organisms this liquid transport medium carries all life essential and non essential elements in human body [1]. The ingestion of many soluble metal salts and metal-containing anions such as chromate (CrO_4^{2-} from lead chromate) may cause local irritation, tissue damage or even systematic poisoning if the metal ion is absorbed in sufficient amount [2]. In trace amounts copper is essential for life due to its role in metalloenzymes (*loc. cit*) but even in moderate low concentration the copper salts cause emesis and considerable gastrointestinal irritation .Lead binds strongly to a large number of molecules, such as amino acids, haemoglobin, many enzymes, RNA and DNA; it thus disrupts many metabolic pathways. Effect at the molecular level such as the interference with steps in haem synthesis occur at very low level equivalent to 20-200µg Pb kg^- soft tissue, which are the level normally found in adults [3]. In fact, all metal loss which has gained access to the circulation in sufficient amount and is not excreted readily is toxic to an extent depending upon the metal itself [4-6]. The toxic effect of the metal ion may be due to its deranging the electrolyte balance, damaging specific organs like the kidney or affecting the central nervous system, or interfering with vital enzymatic processes [7].

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Although there is a considerable variation in the toxic concentration levels, there is no metal ion (including those which serve vital functions in biological systems) that is tolerated at high concentration [8].

Fig. 1: Some automobile workers with dirty hands and clothes

Thus, the normal extracellular concentration of K^+ is 16-20 mg per 100 ml but if its concentration is only doubled by parenteral administration, marked effects on nerve and muscular activity occur that can even cause death due to cardiac depression [9]. Toxic symptoms become evident when the lead concentration in blood reaches 0.08 mg per 100 ml from the normal level of 0.03 mg per 100 ml.[10]

The increased level of heavy metals caused many effect in human body. The other health parameters were indicative of the increasing levels of heavy metals like hyper tension, high sugar level and lower haemoglobin percentage. These effects are caused by heavy metals [11, 12].

Material and Methods

Seven volunteers were selected from deferent work shops and garages for their blood analysis for Lead contaminations [13]. Their previous health records were also analyzed for above mentioned health correlation [14]. The oral health data has also been recorded for investigation. Most of these people narrated that they have had memory problem due to poor ventilation. Some of them reported darkening of skin colour tone as well as vomiting and headache symptoms.

Blood sampling

The specimen should be collected with maximum care. The blood samples were collected from healthy subjects with known history of heavy metal exposure, living in Sagar city of Madhya Pradesh (India).

The blood samples were collected by veiner puncture of antecubital vein with the help of polyolefin disposable syringes with tips of stainless steel, to be used once only, as anticoagulant; 1 ml of sodium citrate (3.5%) solution was taken in the syringe before collection of the samples. The collected sample was transferred into polycarbonated tube and swirled (vortex-mixed) for 1 min. All samples were stored at 4^{o}C prior to separation of plasma from red cells. If required, the plasma and erythrocytes were separated by centrifugation at 1000 rounds per minute for 15-20 minutes. The red cell were washed three times with 0.15 m. Sodium chloride solution and reconstituted to the original volume of blood using demonized (saline) water. All samples were stored in refrigerator unit/required for analysis. The blood sample was centrifuged for 15 min and filtered as a result blood serum separated out for further study.

One healthy person was also examined by AAS for the normal health data and heavy metal concentration in real condition [15, 16]. This served as a control volunteer. All the blood samples were collected from persons working or living near such above mentioned polluted areas. The blood samples were taken by trained pathological technician and were converted in to blood serum form. Later the blood serum was sent for further study by AAS by Atomic absorption spectrophotometer model no. AA6800 make SHINADZU.

Results and Discussion

In the Table 1 the persons from different age group show different level of Haemoglobin (Hb %) and sugar level but all were showing unhealthy stages which is emphasized in their blood analysis. The concentration of blood haemoglobin was less than 13-18% which shows that the increasing concentration of Pb has inhibited the bonding of Fe and glob in protein in blood due to this, the level of Fe becomes low in blood of the volunteer (1)Pb- 0.03 ppm (parts per million)while sugar is in the normal range. The increased level of Pb caused Anaemia [17]. Liver Hepatomegaly was proved by his previous health history. The persons who more selected for the study purpose as volunteers were working in polluted atmosphere for the last 15-20 years.

The volunteer 2 (s) (age 48) had 10.6% Haemoglobin, higher sugar, higher blood pressure and cholesterol and his health record related this with hypothyroidism. The volunteer 3 (v) aged (55) is a garage worker who always his hands in grease had showed 9.8% Hb higher sugar with hyper tension, and squamous cells of Left ear. He also showed some hearing problem since last 10 years [18, 19].

Volunteer 4 (B) aged 40 a painter has higher Pb, his Hb % was 13.6 with higher cholesterol his record proved hyper tension and vomiting problem.

Volunteer 5 (T) age 42 had maximum Pb concentration, Hb percentage was 12.8, sugars and higher cholesterol show the possibility of hypertension, jaundice, due to occupational hazard in automobile workshop.

Volunteer 6(U) and 7 (w) had higher Pb, their age's were 43 and 47, they had low Hb % and low sugar, low cholesterol their occupation was painting and volunteer 8 was the only person who suffering from diebities and lives near garages of Bhagwanganj and used the water sources near Bhagwanganj site B1 and B2 of Sagar city (MP) India these sites have heavy traffic, garages automobile workshops etc. which drained their waste into near water sources. So he allways inhale, drink and absorbs toxic gases that's why his lead content in blood serum is 0.09 ppm.

The volunteer 9(H) was (ND: denotes not detected) a healthy person who neither lives or worked nor used polluted water and had not shown any unhealthy parameters and his sugar, cholesterol is due to his life style not due to polluting atmosphere .

Conclusion

The blood samples of the people exposed to this environment like automobile garages, painting workshops etc. have been investigated. The study shows their polluted environment; unhygienic activities, dirty clothes, low safety precautions etc. and

all these conditions increase high contamination of pollutants like lead metal in living beings [20].

This survey shows that the people living around the Sagar City Lake are suffering from chronic water borne diseases [21]. The concentration of Pb (0.09 ppm) in human blood by their blood serum analysis proved that the diseases like kidney disorder, breathing problem, memory problem, skin disease, gastro-enteritis, dysentery etc. due to higher exposure of pollutants and poor hygienic habits in persons who are living or working in and around such environment [22-23].

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Table 1: General health parameters like haemoglobin (Hb), Blood sugar, Cholesterol level and Lead content in blood serum sample

S.No	Code	Name	Age	Hb%	Gender	Blood Sugar (mg/dl)	Serum Cholestrol (mg/dl)	Pb (ppm)
1	A	Mohd. Sakeem	35	12.2	M	132	255	0.03
2	S	Sayeed	48	10.6	M	145	218	0.01
3	V	Jameel Shaeikh	55	9.8	M	162	180	0.02
4	B	Aakil Khan	40	13.6	M	138.5	265	0.02
5	T	Raju	42	12.8	M	123.6	146.5	0.09
6	U	Suresh	47	9.6	M	128.8	120	0.01
7	W	Manohar	39	11.5	M	118	112	0.03
8	I	Sappi Khan	49	12.5	M	146	203	0.01
9	H	Sher khan	50	16	M	134	203	N.D.

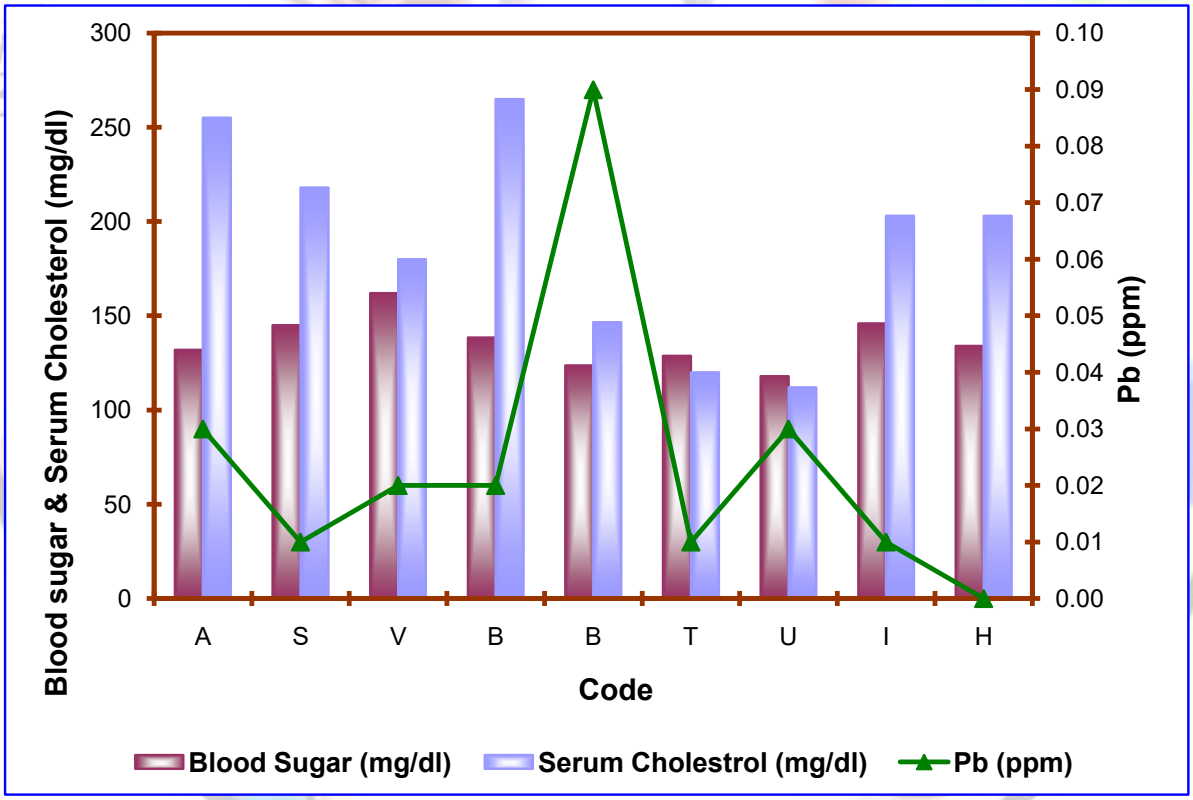

Fig: 2 Blood sugar, serum cholesterol and Lead content in serum smples