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Assessment of Lead Poisoning Among Primary School Children in Gezira State, Sudan

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Abstract
Background: *Lead poisoning is said to be the most common environmental illness of children. The incidence varies with age, socioeconomic status, the population of a given community, race, and the age of the home.*
Aim: *This study is intended to assess lead poisoning among primary School Children in Gezira State and to provide data for assessing the extent and nature of a given community's lead contamination problems.*
Method: *This study was conducted at Gezira State (wad Madni) from primary School Children localized in the main street. A total of 39 samples were collected from three schools (two female schools and one school for male).30 as exposed and 9 as control. Age between 6-14 years old. Blood lead level analysis was carried out by using NIOSH method measured by Atomic absorption . Biochemical tests of renal and hepatic profile were analyzed by Spectrophotometer. Data was collected through questionnaire and packaged to statistical analysis which includes: Descriptive statistic, t.test, analysis of variance (ANOVA), mean difference, regression and correlation were carried out by using SPSS programme version 11.5.*
Result: *contamination by lead was significantly high (3.35), all studied parameters were not significantly difference between lead exposed children and control, but Ca++ and Albumin were slightly higher under lead exposed children , while the control was trace for the other studied parameters.*
Conclusion: *lead poisoned children through its effect on certain metabolic processes.*

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I. Introduction

Lead is one of four metals that have the most damaging effects on human health. It can enter the human body through uptake of food (65%), water (20%) and air (15%) [1]. Lead levels in the air have gone down greatly since lead was taken out of gasoline in the 1970s. [2]

These interactions allow lead to affect different biologically significant processes, including metal transport, energy metabolism, apoptosis, ionic conduction, cell adhesion, intercellular and intracellular signaling, diverse enzymatic processes, protein maturation, and genetic regulation. Nervous system is particularly susceptible [10]. The effect of lead on children's cognitive abilities takes place at very low levels(less than 5 $\mu g/dl^3$,) In the present study, we evaluated the time dependent changes in the serum biomarker of hepatic injury, ALT, AST and liver tissue histopathological changes at time interval of 6, 12 and 24 hrs after single intra peritoneal injection of lead acetate (10 or 100 mgKg-1). Lead acetate at 10 mgKg-1dose causes a mild significant positive elevation of serum ALT,AST only after 24 hrs ($p<0.05$) while at 100 mgKg-1, it causes a significant time dependent increases in serum ALT, AST ($p<0.001$), when compared to the control untreated group. [9] .Some studies showed that blood lead levels are positively correlation associated with total and HDL cholesterol.[9], also The synthesis of the protein is induced at blood lead concentrations above 1·9 μmol/L, but is reduced below 4·0 μmol/L.[8] it decreased plasma albumin levels is related hepatocellular disease include increased immunoglobulin levels; third-space loss and direct inhibition of synthesis by toxins such as lead. [7].

lead causes proximal tubular injury with a characteristic pathology of proximal tubule and diminished renal clearance, tubular reabsorption and glomerular filtration rate [11]. Lead also affect the metabolism and concentration of calcium , In most instances, the characteristics of lead allow it to bind with greater affinity than calcium and zinc ions to protein binding sites. These interactions allow lead to affect different biologically significant processes, [10].

Lead exposure is an important environmental health problem particularly affecting the children of occupational children living in the lead-contaminated environment. So the objectives of this study to find out the frequency, potential sources and adverse health effects of elevated blood lead level (BLL) in the children.

II. Material and Methods

Materials

Study area: from Gezira state (Wad Madni) primary school children ,three schools involved two are females and one is males for collecting control sample., However, the control samples were collected from children's in schools located far from roads with heavy traffics.

Sample size: the study involved 30 sample from exposed children and 9 as control, To assess the effect of lead poisoning on studied children , the study involved different parameters related to lead concentration in the body, so in each sample we can estimate the concentration of , lead as the main parameters, Ca++ , Creatinine(as an indicator to renal function), and cholesterol (lipid profile), Alanine amino transferase (ALT) and Albumin, Total bilirubin, Direct bilirubin all as indicators for liver function.

The application of estimated sample was applied to control samples to compare between exposed children and control samples.

Methods

Method for lead estimation by Analytical Method for Atomic Absorption Spectroscopy

BC-5 Analysis of serum and plasma: lead Scope

This method was described and determined of lead in serum and plasma. Samples were diluted by de ionized water. The analysis was performed against standards which prepared in glycerol to approximate the viscosity characteristics of the diluted samples.

Normal serum levels 10-20µg/dl

Normal serum levels 0.001-0.002mg/dl

Typical Analytical Procedure lead of Sample

Preparation of sample: for determination of lead in serum, the samples were diluted with deionized water by 1:5 respectively**.**

Analysis: the concentration of lead was determined by using the conditions listed in the˝Standard Conditions˝ section. Lead standards were prepared by diluted the lead stock standard solution, described in the˝Standard Conditions˝for lead, with 5% (v/v) glycerol. A 5% (v/v) glycerol solution was used as blank solution [12].

Standard Atomic Absorption Condition for lead:

Wavelength Slit	Relative Noise	Characteristic concentration	Characteristic concentration	linear Range
(nm)	(nm)	(mg /l)	(mg/dl)	(mg/l)
203.9	0.7	0.018	0.001	0.9
307.6	0.7	79.0	0.0035	0.9

1-Recommended Flame; air-acetylene, oxidizing (lead, blue)

2-Data obtained with standard nebulizer or impact lead will typically provide a 2-3x sensitivity improvement**.**

3-Characteristic concentration with **a N2O-C2H2** flame at 203.9 nm: 0.084 mg/l.

4-Table contains HCL data. EDL sensitivity values approximately the same.

Standard Flame Emission Conditions for lead:

Wavelength (nm)	Slit (nm)	Flame
203.9	0.3	Nitrous oxide-acetylene

Stock Standard lead was about 500 mg which Dissolved in 0.500g of lead metal in minimum volume Solution of (1+1) HCL and diluted to liter with 1% (v/v) HCL light Sources , both Electrode less Discharge Lamps (EDLs) and Hollow Cathode lamps were available for lead. EDLs provided greater light output and longer life than Hollow Cathode Lamps. For lead, both EDLs and Hollow Cathode Lamps provided approximately the same sensitivity and detection limit.

Detection for liver and renal function Spectrophotometery by using[14] method for TG, [4] method for cholesterol ,Calcium determined by using [6], [5]method for Creatinine estimation, [5] for ALT, [6]for albumin, [13]for total protein.

III. Results

Table(1) showed that there was +ve and insignificant relationship between exposed lead levels and their cholesterol, Creatinine , ALT, T. protein ,T.bilirubin while there was –ve , weak and insignificant correlation with Ca++, TG, and albumin levels at ($p<0.05$) .

In Medani city lead levels were significantly (P<0.01) higher (3.34) in lead exposed children as compare to control subjects (2.00), and the percentage of elevation was estimated by about 67.0% (table 2) also showed that all other studied parameters were not significantly difference between lead exposed children and control, but Ca++, TG and Albumin were slightly higher under lead exposed children, while the reverse was trace for the other studied parameters.

Table 1: Correlation between exposed children lead levels and biochemical parameters at Medani city.

Variable	**Lead concentration Coefficient &Probabilty (r)**	**(P)**
Ca++	ns -0.138	0.443
TG	ns -0.041	0.822
Cholesterol	ns 0.007	0.967
Creatinine	ns 0.028	0.876
ALT	ns 0.126	0.484
T.protein`	ns 0.005	0.977
Albumin	ns -0.058	0.749
Total bilirubin	ns 0.046	0.800

ns: no significant correlation

Table 2: Comparison between lead exposed children and control for some biochemical parameters at Medani city

Parameters	**exposure**	**control**	**d.f**	**S.E±**	**t.value**	**significance**
Pb	3.34	2.00	37	0.22	6.05	**
Ca++	9.24	9.32	37	0.05	1.52	ns
T.G	42.34	42.63	37	1.22	0.23	ns
Cholesterol	146	144	37	5.4	0.37	ns
Creatinine	0.64	0.71	37	0.08	0.95	ns
ALT	14.53	14.62	37	0.22	0.43	ns
T.P	6.63	6.69	37	0.10	0.55	ns
Alb	3.92	3.94	37	0.08	0.22	ns
T.bilirubin	0.66	0.70	37	0.05	0.84	ns

ns: No significant correlation.

****: significant correlation at 0.01 level of probability**

IV. Discussion

The characteristics of lead allow it to bind with greater affinity than calcium and zinc ions to protein binding sites. These interactions allow lead to affect different biologically significant processes, [10].level of calcium decreased with increase concentration of lead in exposed children(9.24mg/dl) as compare with control(9.24mg/dl), Some studies showed that blood lead levels are positively correlation associated with total and HDL cholesterol. [9],lead modify the metabolism of lipids, Since the average blood lead level of exposed children was 3.34 (as in table2) below the standard lead level this might that no threshold level below which lead causes no injury. The synthesis of the protein is induced at blood lead concentrations above 1·9 μmol/L,[8]. This study was found that positive correlation between liver enzymes , total protein with lead reflect modification of protein genes by elevated level of lead, albumin direct inhibition of synthesis by toxins such as lead. [7].So lead exposed children showed negative correlation .lead can affect to tubular reabsorption and glomerular filtration rate for some molecules when it reach high concentration this reflect no effect of lead in renal function in studied children.

The present study stated that there was no significant difference between exposed and control children in all parameters which reflect general lead poisoning either in school localized in main street and away from main roads.

V. Conclusion

Environmental toxicities by lead spread in Gezira state which affect liver function of primary school children.

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Recommendations

The negative effects of lead can be limited by reducing future exposure to lead. Schools must structure curriculum that promote a non-toxic environment for all. The role of teachers, parents and communities is to protect its young by having a healthy, safe and orderly environment for all of its children. Also balanced nutrition must be taken which may prevent or reduce lead poisoning and frequent meals free from high –fat must be taken.

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