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## Determination Of Blood Lead Concentration In Patients With Asthma .

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**Abstract** . This study was designed to determine the concentration of lead and Immunoglobulin E in blood of patients with asthma .Study include 60 samples divided for two group ,first group include 35 samples for patients with asthma there age were between 25-65 years and the age average was  $47.95 \pm 1.4$  also this group divided for two subgroup young patients which include 17 samples and aging patients which include 18 samples ,and the second group include 25 samples for normal peoples there age average were  $34.9 \pm 2.1$  which divided for young and aging samples. Results showing significant increasing in lead concentration in blood of patients with asthma in both young and aging people as compared with normal people(control group) .Lead concentration were  $8.98 \pm 2.2$  in young control and elevated significantly in young patients to  $25.2 \pm 2.3$ , and  $12.9 \pm 2.4$  in aging control was elevating significantly to  $31.6 \pm 2.1$ . Immunoglobulin E (IgE) was increase significantly  $p < 0.01$  in blood of patients with asthma in both young and aging samples compared with control groups, IgE concentration were  $41.6 \pm 2.4$  in young samples and increase significantly to  $81.2 \pm 3.1$ , and in aging samples were  $56.5 \pm 2.4$  increase significantly to  $90.7 \pm 2.5$ .

**Keywords** : Lead concentration , Asthma , blood ,young patients ,aging patients, Immunoglobulin E.

### Introduction

Lead is one of the oldest heavy metals whose physiological effects have been widely studied as one of the most important factors of environmental and occupational poisoning. Where many studies indicate that the proportion of people who die annually due to lead poisoning is about 0.6%, or about 143,000 people around the world (Seema et al ; 2014). .Lead compounds are transported to the blood in several ways, including through the respiratory system through the inhalation of fine particles in the air due to air pollution in lead compounds emitted from fuel combustion and thus the arrival of these particles into the lung and absorption and can be entered through the skin (Alrudainy ,2010). Accumulation of lead compounds significantly leads to poisoning that affects the functions of many organs of the body, such as the respiratory system, digestive system, immune system, circulatory system, nervous system, urinary and reproductive system (Seema et al ;2014). The presence of lead in high concentrations in blood indicates to lead poisoning, and this is a reliable source because 90% of lead is associated with red blood cells (Gray et al ;1985). The increase in the lead rate in the biological environment is one of the most important health problems facing the global communities. Poisoning lead compounds result in many diseases, including Asthma, where many studies indicated exposure to



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lead compounds significantly result in a defect in the immune system, which contributes to increase the risk of diseases including asthma (Sun et al ;2003). Many studies indicate the role of lead exposure which alerts immune system compounds and associated with increased production of Immunoglobulin E (Ahmed et al ; 2015).

### **Lead concentration**

The lead element is a heavy material that has a significant impact on cells in humans, has a genetic role implanted within the genetic material of living cells, in addition to the toxic role of the same cells in addition to mental disorders that occur because of high concentration in the blood of people. Lead poisoning is a serious environmental health hazard (Joseph et al ;2005). Lead is a metal with many important industrial uses. The relation between lead exposure and blood pressure rise has received a great deal of attention because the implication that mortality from cardiovascular and cerebrovascular disease might be reduced by lowering lead values in the environment. In the past some authors showed an excess of mortality in workers in plants where they were exposed to extremely high levels of lead. More recently however such exposure was reduced substantially and the effect of lower levels of lead exposure in the industrial setting is controversial (Concettina et al;2006). Many studies are in agreement that there is a correlation between asthma and high levels of lead in blood. The epidemiology of asthma referred to the role of lead poisoning and the relationship between them was described and both are prevalent in the people among the world and it increases the risk of diseases. Lead poisoning and asthma are common pediatric health problems because both of these diseases have environmental mechanisms. (Hartert & Peebles;2002).

### **Sources of Lead Exposure**

Lead paint is a primary source of lead exposure and the major source of lead toxicity in children. The second source of lead is the dust and soil, Exposure to soil that contains particulate lead has been shown to be significantly hazardous for children, who are more commonly exposed by ingestion of house dust or soil than by paint chips. Drinking water is also a major source of lead exposure, estimated to be responsible for approximately 20 percent of the total daily exposure. **Food** This is a major source of lead intake for the adult population. Produce can be contaminated from airborne deposition and lead-rich soil, though this can be reduced with careful washing. Previously, leaded solders in cans and wine bottle capsules contributed to lead intake in the general population, but these have been phased out. In the home, the use of lead crystal or ceramic tableware glazed with leaded glazes can cause a small contribution, but such articles manufactured in the Western World are tested to ensure that leaching is acceptably low. (Lyn ; 2006). Herbal remedies from India, China, and other parts of Asia may be potential sources of lead exposure. Certain Ayurvedic herbal products manufactured in South Asia were found to be contaminated with lead ranging from 5-37,000 µg/g (Saper et al ; 2004). **Air** – Direct absorption by inhalation is a minor exposure route for most people, though it can be significant to individuals occupationally exposed. Airborne lead-containing particles fall to earth, most within a short distance of source, and add to lead contents of dusts, soils and food. A weak link between levels of lead in air and exposed populations has been established. The WHO

recommended an air quality standard in 1987 of 0.5-1.0 µg/m<sup>3</sup>. The EU lead in air standard is currently 0.5 µg/m<sup>3</sup> and the UK has set an air quality target of 0.25 µg/m<sup>3</sup>. Air lead levels are falling in Western Europe, as leaded petrol is being phased out. Elevated levels can be found in some industrial areas. **Soil and dust** – Ingestion of soil and house dust is a major pathway for the exposure of young children to lead, due to “hand-to-mouth” activity. Workers in certain occupations are also exposed to high levels of lead. Lead exposure occurs during the manufacture of ammunition, batteries, sheet lead, solder, some brass and bronze plumbing, ceramic glazes, caulking, radiation shields, circuit boards, military equipment (jet turbine engines, military tracking systems), intravenous pumps, fetal monitors, and some surgical equipment. Construction workers are known to have a high risk for lead exposure (Lyn ;2006 : Mona et al ;2015). Published analyses suggest that lead exposure may result in alterations to

immune system components known to be associated with asthma, Lead has been associated with the increased production of total immunoglobulin E (IgE), which is also observed in atopic and nonatopic individuals with asthma (Christine et al ; 2005). The immunotoxic or immunomodulatory effects of lead have been demonstrated recently in animal models, and include impaired host resistance to infections and an enhancement of alloantigenic-specific T-cell proliferation by altering antigen processing and presentation (Sun et al. (2003) reported an association between lead and increased IgE in studies of young children.

### **How people are exposed to lead**

Most people are exposed to lead through diet; drinking water may also contribute in areas where old lead service pipe is still present or water pH is such that lead leaches from old solder or other lead containing components of pipes or fixtures. Other sources of lead exposure include hobby or occupational exposure, local or neighbourhood sources such as active lead smelters or historical soil contamination from old industrial activity, traditional medications and cosmetic products. Occasionally toys or consumer products not meeting Canadian standards or paint removal as part of household renovations are also identified as a source of exposure. Secondary exposure within a family can occur if household members bring lead home on their clothes or in their vehicles. Children may be exposed to lead from hand-mouth activities involving contaminated dust and soils in and around older homes that contain lead-based paint or from eating paint chips that contain lead. (American college of medical toxicology; 2010).

### **Methods and materials**

#### **1. Experimental design**

This study was designed to determine the concentration of lead and Immunoglobulin E in blood of patients with asthma. Study include 60 samples divided for two group, first group include 35 samples for patients with asthma their age were between 25-65 years and also this group divided for two subgroup young patients which include 17 samples and aging patients which include 18 samples, and the second group include 25 samples for normal peoples which divided for young and aging samples.

#### **2. Collecting Blood samples**

Blood samples were collected through Venipuncture, 5ml of blood were dropped and left at room temperature for 15 minutes in water bath 37 °C, after that we centrifuged the samples to get the blood serum which kept in the fridge until the time of testing.

#### **3. Determination of blood lead concentration**

The serum concentration of lead in the blood was measured for people with asthma and healthy subjects, by the use of kit lead-based serum analysis based on electrochemistry and the presence of lead in the blood and after reading the absorbance using the spectrophotometer. Results were compared with the patient sample and healthy.

#### **4. Immunoglobulin E Concentration**

Total Immunoglobulin E (IgE) was measured in serum by quantitative enzyme Immune assay based on solid phase ELISA. Total IgE Concentration was considered high when it exceeded the normal range (200 IU/ml).

#### **5. Statistical analysis**

Data was analyzed by SPSS (Statistical Package for Social Sciences) version 12. Chi-square test was performed to compare individual characteristics and the t-test was performed to compare the patients

with asthma and control groups. Results were expressed as the mean  $\pm$  standard deviation (SD). Significant values of P at  $< 0.05$  and  $< 0.001$  were considered.

## Results and discussion

### 1. Lead concentration

The results of the present study, shown in the table below (Table 1), showed a significant increase in lead concentration in the blood of people with asthma in both the elderly and youth groups when compared with control groups. The concentration of lead in the control group for youth ( $8.98 \pm 2.2$ ) was significantly increased to ( $25.2 \pm 2.3$ ) in the asthma group. There was also a significant increase in lead concentration in the elderly group with asthmatics when compared to control group, ( $12.9 \pm 2.4$ ) and increased significantly in the elderly group to ( $31.6 \pm 2.1$ ).

**Table -1.** Lead concentration in blood(  $\mu\text{g}/\text{dl}$ ).

Group	Youth ( $\mu\text{g}/\text{dl}$ )	Elderly ( $\mu\text{g}/\text{dl}$ )
<b>Control</b>	$8.98^a \pm 2.2$	$12.9^a \pm 2.4$
<b>patients</b>	$25.2^b \pm 2.3$	$31.6^c \pm 2.1$

N= 60 samples , small letters(a,b,c) referred to the significant differences ,  $\pm$  SD.

The results of the current study are consistent with many recent studies in proving the effects of accumulation of lead and its high concentration in the blood with the emergence of many health disorders and diseases. The high accumulation of lead in the biotic environment and the cities where the proportion of fuel and lead containing substances increase Environments making it in touch with people's lives. Sirwan (2014) noted that the high level of lead is cumulative in people working in refueling stations or those who live nearby. This accumulation is accompanied by many health risks. The results of our study also agreed with the study of Ali Khan et al. (2013), which confirmed that chronic exposure to lead and its toxic derivatives affect the functioning of many body systems negatively. Lead has a capacity to modify the immune reactions by activating type 2 helper T-Cell and inhibiting type1 helper T-Cell activation , this effect is dependent on the enhanced production of cytokines and interleukins therapy promoting isotype switching to IgE(Jedrychowski et al ;2011).

### 2. IMMUNOGLOBULIN- E(ige).

The results of the present study, shown in the table below (Table 2), showed a significant increase in IgE concentration in the blood of people with asthma in both the elderly and youth groups when compared with control groups. The concentration of IgE in the control group for youth ( $41.6 \pm 2.4$ ) was significantly increased to ( $83.2 \pm 3.1$ ). In the asthma group there was also a significant increase in lead concentration in the elderly group with asthma when compared to control group, ( $56.5 \pm 2.4$ ) and increased significantly in the elderly group to ( $90.7 \pm 2.5$ ).

**Table-2 .**Immunoglobulin-E levels.

Group	Youth ( $\mu\text{g}/\text{dl}$ )	Elderly ( $\mu\text{g}/\text{dl}$ )
<b>Control</b>	$41.6^a \pm 2.4$	$56.5^c \pm 2.4$
<b>patients</b>	$83.2^b \pm 3.1$	$90.7^d \pm 2.5$

N= 60 samples , small letters(a,b,c) referred to the significant differences ,  $\pm$  SD.

Asthma is of two types, Intrinsic and Extrinsic . Extrinsic include subtype caused Atopic Asthma in which patients who have a hyper responsive airway, the sensitization to inhaled antigen and chemical

antigen (Mathias et al ; 2009). In this study our results found that elevated total IgE levels in serum of patients with asthma .The results of the present study, through the results of the statistical analysis and the information shown in Table 1, indicate that there is no significant difference in the concentration of lead in the blood of the control group (healthy) in youth and elderly. While there was a significant difference in the level of lead in the blood of people with asthma from young people and the elderly when compared with the control groups of healthy young and old. We also noticed a significant difference in the level of lead in the blood of people with asthma in the control group of young people and elderly, which may be due to age difference and the length of exposure and lifestyle(Sangslim et al ; 2016). The previous studies have suggested that the lead exposure alters immune system components is associated with many steps in the pathophysiology of increase bronchial hyper responsiveness(Ahmed et al ;2015). Our results agreed with many studies about the significant increasing of total IgE levels in serum of patients with asthma (Viabhav et al ; 2017).

The results of the present study, through the results of the statistical analysis and the information shown in Table 2, indicate that there is a significant difference in the concentration of IgE in the blood of the control group (healthy) in youth and elderly. While also there was a significant difference in the level of IgE in the blood of people with asthma from young people and the elderly when compared with the control groups of healthy young and old. We also noticed a significant difference in the level of IgE in the blood of people with asthma in the control group of young people and elderly (Jedrychowski et al ; 2011).

The mechanism for the association between lead and increase total IgE levels and specific allergen sensitization are not fully understood . There are two types of hypersensitivity ,type 1 has implication for lead exposure ,and IgE is a major mediator of type1 hypersensitivities (Kyoung & Jin; 2012).

### Conclusions & Recommendations

Our findings provide important evidence that lead and IgE levels represent important risk factors for asthma. Moreover, our study demonstrates that total IgE level is a significant factor in the association of lead levels with asthma. Future longitudinal studies should clarify the roles of lead high exposure in asthma, high total IgE levels, and allergen-specific sensitization in other populations and ethnicities.

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