Estimation the Correlation between Heavy Metals and Oxidative Stress in People Living Near Incineration in Al-Nasr City in Thi-qar Governorate

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Abstract. Background: The current study is a prospective research. Some laboratory tests were done on people living near incineration in Al-Nasr city in thi-qar governorate. This scientific study has its goal as providing social benefits through supporting and augmenting the efforts of Environmental Authority in their work of organizing and monitoring waste disposal processes, with due consideration to the health status of these individuals to help decrease the incidence of waste burning besides finding safe solutions for waste disposal. Methods: The samples were collected from people living near incineration in Al-Nasr city in Thi-Qar governorate. Seventy five samples of blood obtained from subjects residing near incineration, and seventy five samples also obtained from normal individuals as a control group, subject's age ranged between (20-60) years, during the period from October 2022 up to April 2023. Serum levels were assayed for lead (Pb), cadmium (Cd), zinc (Zn), malondialdehyde (MDA), Glutathione (GSH) and albumin (Alb). Results: A highly significant increase in serum Pb, serum Cd, serum Zn, and serum MDA in people living near incineration as compared to the control group was observed. A significant decrease in serum GSH, and serum Alb in people living near incineration as compared to the controls group was found. The study reported a positive correlation between Pb and (Cd, Zn, MDA) while it reported a negative correlation between Pb and (GSH, Alb).

Highlights:

1. Prospective study on health impacts of incineration in Al-Nasr city.
2. Blood tests on 75 residents, 75 controls; analyzed Pb, Cd, Zn, MDA, GSH, Alb.
3. Increased Pb, Cd, Zn, MDA; decreased GSH, Alb; correlations observed.

Keywords: Oxidative stress, Lead, Cadmium, Zinc, Glutathione, Albumin

Introduction

Harmful substances are produced which emanate during the incineration process into the air, with the products of incineration (ash and slack) [1]. Air emissions are by far the most common route of human exposure [2]. The particulate count, dioxins, furans, PAHs and heavy metals in terms of unfavorable atmospheric emissions are gaining greater hobby concerning fitness outcomes [3-5]. Chronic incinerator particle

exposure has been known to increase mortality-mainly due to cardiovascular, cerebrovascular and respiration illnesses — at the same time as acute incinerator particle publicity is understood to motive mortality normally through outcomes on cardiopulmonary characteristic main to death like coronary heart attack or lung sickness [6-8]. Many research have located that publicity to risky materials from incinerators will increase cancer hazard; tender-tissue sarcomas being most regularly stated amongst such instances [9,10] in addition to non-Hodgkin lymphomas [11-13] with a capability hyperlink to dioxin publicity from those assets. The ranges of pollution have risen notably and so has publicity to non-essential heavy metals consisting of lead , arsenic, cadmium, and mercury. It is now a first-rate worldwide danger [14-17]. The majority of heavy metals are redox-lively species. In situations in which the antioxidant defenses aren't sufficient to avoid this, they'll motive overproduction of reactive oxygen species (ROS) because of their oxidation–discount properties. As a result, this leads to oxidative damage. In current years a large number of studies have defined higher oxidative strain as an outcome of publicity to heavy metals [18]. Oxidative stress leads to the formation of products of oxidation. Endogenous antioxidants are depleted as a result of this process. Damages cellular structures and macromolecules in excess quantities lead to cellular dysfunction, ultimately resulting in cell death due to the overwhelming amounts of reactive oxygen species involved [19,20]. This research aimed at estimating the levels of Lead, Cadmium, and Zinc and their relationship with oxidative stress among people living close to the incinerator since exposure to these metals may cause severe health problems. Moreover, because these metals are capable of accumulating in the body, they can cause various health issues, including but not limited to problems related to oxidative stress.

Methods

The present study is a prospective research. Samples were collected from people living near incineration in Al-Nasr city in Thi-Qar governorate. Seventy-five samples of blood were obtained from people living near incineration, and Seventy-five samples of blood were obtained from normal people as a control group; the subject's age was between (20-60) years. The study was conducted from October 2022, to April 2023. About five milliliters of blood was collected and allowed to clot at room temperature for

ten minutes in hollow disposable centrifuge tubes; then acceleration due to gravity in a centrifuge was done at a force of 3000 revolutions per minute (rpm). The serum samples were stored at -20 °C until used for the determination of biochemical parameters. The serum was used to estimate (lead, cadmium and zinc, MDA, glutathione and albumin).

Determination of Serum Lead, Cadmium and Zinc Concentrations:

Principle:

The serum samples were analysed for the concentrations of the three components by flame atomic absorption. This method involves capturing light from a low-powered cathode lamp using ground state atoms in a lean air-acetylene flame. The volume of light absorbed is exactly proportional to the concentration of gaseous atoms along the light path, and thus, to the concentrations of lead, cadmium and zinc in solution.

Digestion of samples:

2.5 mL of concentrated nitric acid and an additional 0.5 mL of serum were added to the sample in a Pyrex bottle that contained 1.5 mL of concentrated perchloric acid. The oil bath was heated to 160 °C for 1 hour, after which the sample was cooled to 10 mL and augmented with 10 mL of 0.3 N hydrochloric acid.

Determination of Serum Malondialdehyde Concentration

Principle:

Lipid peroxidation was assessed using the TBA technique. This approach regards MDA as a result of polyunsaturated fatty acid breakdown and a product of lipid peroxidation (LPO), which reacts with TBA in the presence of trichloroacetic acid (TCA) to provide a red chromophore absorbable at 532 nm. This is termed a "absorptive" colour. The concentration of MDA was determined using the molar extinction coefficient of MDA (ε MDA), which is 1.56×10^5 mol-1 L cm-1 [22].

Determination of Serum Glutathione Concentration

Principle:

The approach relies on the reaction between 5,5'-dithio-bis(2-nitrobenzoic acid) (DTNB) and aliphatic thiol compounds at a pH of 8, yielding one mole of p-nitrothiol phenol for each mole of thiol. This colourless anion (ε = 13600 at 423 nm) may be used to quantify thiol concentrations.

Determination of the Serum Albumin Concentration

Principle:

One of the key proteins in the serum that is generated by the liver is albumin. Methods have been developed to evaluate the concentration of albumin. The most fundamental approach is the colorimetric method of bromocresol green (BCG method). The measuring approach is based on the fact that BCG has a comparatively high affinity for Alb. Under the circumstances of pH 4.2, albumin coupled with BCG causes the indicator to shift from yellow to green-blue". The degree of the color's intensity is exactly proportional to the content of albumin in the sample, serum or plasma, without a hemolytic supplement [24].

Statistical Analysis

Experiment effects were said as mean ± standard deviation. The one-way ANOVA check is what was used to evaluate parameters among exclusive companies. A p-cost of much less than 0.05 changed into taken into consideration statistically tremendous. The diploma of correlation (if any) among the diverse parameters in each group of patients become analyzed the use of the person correlation coefficient (r).

Result and Discussion

Table 1 shows levels of (Pb, Cd and Zn) in people living near incineration significantly higher than those in the control group ($P \leq 0.05$)

Table 1 shows the levels of pb, Cd and Zn in people living near incineration and controls.

Groups	No.	Pb (µg/dL) (Mean ±SD)	Cd (µg/dL) (Mean ±SD)	Zn (µmol/mL) (Mean ±SD)
people living near incineration	75	4.98±0.78	9.34±1.22	29.78±7.89
Control	75	2.31±0.57	1.78±0.23	11.45±1.89
p-value		0.007	0.005	0.002

Table 2. shows oxidative stress markers in people living near incineration and control subjects The results revealed that there was a highly significant increase in serum MDA concentration among people living near incineration as compared with the control

group .While it was found that there is a significant decrease in serum (GSH and Alb) concentration among people living near incineration when compared with controls.

Table 2 shows the levels Oxidant-Antioxidant Status in people living near incineration and controls.

Groups	No.	MDA (μmol/L) (Mean ±SD)	GSH (μmol/L) (Mean ±SD)	Alb (g/dL) (Mean ±SD)
People living near incineration	75	3.67±0.78	379.87± 39.21	3.925±0.61
Control	75	1.23±0.24	528.19±49.29	4.94±0.89
p-value		0.009	0.003	0.021

Table 3 shows the is a positive relationship between Pb and (Cd, Zn, and MDA). While it was found a negative relationship between Pb and (GSH and Alb).

Table 3: The relationship between Pb and other parameters in study

Pb with

Pb with	r	p-value	Result
Cd	0.45	0.008	Significant positive correlation
Zn	0.39	0.030	Significant positive correlation
MDA	0.59	0.001	Significant positive correlation
GSH	- 0.41	0.027	Significant negative correlation
Alb	- 0.35	0.042	Significant negative correlation

This study was aimed to be an analysis of heavy metal levels and its relation with oxidant-antioxidant status in individuals living near incineration. Regarding the results observed a highly significant increase in lead and mercury-zinc MDA findings while having found decrease as well within (GSH), (Alb). Production of enormous amounts of solid waste is one of the inevitable outcomes that has been derived from urbanization and globalization which raises environmental problems [20]. The amount will reach 2.2 billion

tons by 2025 [25] according to research data available so far! Comprehensive solid waste management remains challenging task for municipal administration which was not solved during past decades since different methods were recently invented [26]. The composition of strong waste is what has induced a wide variety of impurities to be located in it [27]. For instance, heavy metals may be added. Heavy metals represent one of the maximum crucial impurities in stable wastes. It is found in many sorts of waste, consisting of batteries, digital waste, or even [28, 29] cigarette ends. Because these impurities are the components in recyclable waste, the awareness of heavy metals in municipal solid waste depends on how well separated1 is finished. In developing international locations wherein the charge of separating steel from waste is low, it's going to probable have a better attention among its mass and people by way of-merchandise—including landfill leachate and incinerator ash — as nicely get extra human beings affected considering pollutant routes' significance but additionally extra crucial ways [30,31]. Hence the development of effective solid waste control with accelerated recycling ratios of waste (which reduces the extent of waste disposed in landfills and incinerators) may be powerful in decreasing pollution as a consequence of solid wastes including heavy metals. One manner thru which heavy metals motive harm to human fitness is through oxidative strain. Oxidative pressure (OS) is defined as an imbalance between oxidants and antioxidants cons observed via overproduction of (ROS). A wide variety of heavy metals have redox residences which can also facilitate the generation (manufacturing) when there is overproduction — and sports of reactive oxygen species and additionally cause their being termed heavy metals if antioxidant defenses aren't enough to prevent this process, leading to oxidative damage. In recent years, many research determined publicity to heavy metals associated with better levels for oxidative pressure [32,33]. Oxidative stress due to heavy metal exposure could bring about lipid peroxidation, DNA damage, and protein degradation. At the end of it all, this can cause cellular dysfunction and programmed cell death or necrosis [34], which may have diverse implications on health such as neurodegeneration, cardiovascular diseases and cancer; all these could be related to mechanisms through which oxidative stress by itself causes.

Conclusion

Based on the results, it is concluded that people living near incineration have a high levels of Pb, Cd, Zn and MDA. A positive correlation was shown between Pb and (Cd, Zn and MDA). While it was found a negative relationship between Pb and (GSH and Alb). Heavy metals is a capable of building up in the body and causing a range of health problems, notably oxidative stress

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