

Does Exposure to Lead Have Any Impacts on Children's Sexuality?

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Abstract: Lead has so many adverse effects on humans, among such effects its impacts on sexual glands, sex hormones and reproductive system can be noted. The present study aimed to examine the relationship between blood lead levels and the natality rate and children's sexuality. The blood lead levels were measured through using methyl isobutylketone and ammonium pyrrolidine dithiocarbamate and applying the atomic absorption spectrophotometry device at a wavelength of 217 nm and drawing the standard curves. The required personal information about the number of children and their genders were collected using questionnaires. The obtained data were analyzed statistically. The results showed that there was a significant correlation between the blood lead level and the natality rate and children's sexuality. Those whose blood lead level was higher than the others had less number of kids and they had more female kids. This correlation was stronger and more statistically significant for subjects' last child. Due to the fact that there was a significant relationship between the level of blood lead and the natality rate and children's sexuality; hence, this must be considered and its various aspects should not only be studied but also the prevention services should be developed in this regard.

Key words: Children's Sexuality • Blood Lead Level • Natality Rate

INTRODUCTION

Lead is a toxic heavy metal that has numerous effects and complications on the biological systems of living organs including human beings and creates a variety of risks [1]. Among its effects, Plumbism (lead poisoning), initially described by Hippocrates, can be noted [2]. Since then, many researchers and scientists have paid attention to this toxic substance, its numerous effects and complications from various aspects. One of the features of this toxic substance is its ability to accumulate in the body. Hence, gradually and over time, it has accumulated in the tissues, organs, biological fluids and other parts of individuals at risk and creates harmful

effects. This toxic substance acts chronically and its complications spectrum is widespread and extensive [3]. This poison doesn't only impact the hematopoietic system, teeth, kidneys, digestive system, respiratory system, etc. but it also disrupts their performance and has a great effect on the reproductive system, disrupting individuals' fertility [4]. In a way that so many researchers and scientists have focused on this matter; some of these studies are mentioned in the current study.

In a study carried out on the epidemiology and etiology of males' infertility, Irvine emphasized on the role of environmental factors including chemical factors such as lead [5]. In another study, Lancranjan and his colleagues concluded that lead exposure reduced the

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exposed individuals' fertility [6]. Ustinkina *et al.* indicated that environmental factors including lead have a great power to disrupt the exposed individuals' reproduction system [7]. Moreover, in a study carried out to investigate the risk factors affecting male infertility, Velez de la Calle and his colleagues referred and paid attention to this matter [8]. Figà, in a study that examined the occupational risk factors, health and reproductive health, discussed the role of these factors and considered lead as one of these effecting factors which has a great impact on disrupting reproduction and health [9]. In another study, Massaad *et al.* [10] studied the ways through which chemical compounds like lead can alter fertility. They analyze this issue and pointed out the role of these chemical substances in disrupting individuals' reproduction [10]. Therefore, based on the numerous studies carried out on this matter, it can be inferred that there is a correlation between lead poisoning and reproduction, fertility, sperm quality and quantity and the power of natality. Accordingly, it can affect the number of children and children sexuality distribution. Considering these studies which put an emphasis on the disruption of spermatogenesis ability and impairment of fertility in exposed individuals, the present study aimed to examine this issue in the staffs of Kermanshah oil refinery whom are exposed to lead organic compounds.

In refineries, including Kermanshah refinery, to produce gasoline with high quality of combustion, they increase the octane rate of gasoline, on the other hand to slow down the combustion process of gasoline, they add tetraethyl lead to gasoline. One of the features of this compound is that it can be easily evaporated and its vapor enters the body through respiration, skin, mucous membranes and lack of personal hygiene. This substance has the property of being accumulated in tissues and organs and over time its accumulation in the body increases and crosses the threshold limit that is defined for the body. This increases the likelihood of adverse injuries including reducing fertility in exposed subjects.

Since most of the people in the society both males and females tend to have healthy preferably boy offspring; therefore, identifying the obstacles and solving the problems of achieving this long lasting demand is essential. Thence, the present study aimed to examine and describe the relation between lead contamination and the number of children and their gender with the hope that it might be an effective step toward further understanding of the barriers in the way of fulfilling this desire.

MATERIALS AND METHODS

In this cross-sectional study all oil refiner workers in Kermanshah (150 individuals), working in various units (refinery operation unit, refinery maintenance, reservoir, tin maker and tin filler), who were exposed to lead vapors were selected as the experimental group and a group of 70 individuals working at the West textile factory had no occupational exposure to lead were chosen as control group. Since it was likely that fertility and gender of children be affected by age, the age of the control group subjects were close to the experimental group subjects' age. A questionnaire was prepared for each subject including personal information such as age, number of children, gender and sexuality of their first and last child (up to the study). The subjects were also justified. Their blood samples were taken and were transported to the laboratory for measuring their lead concentration level. Methyl isobutylketone (M.I.B.K) and ammonium pyrrolidine dithiocarbamate (A.P.D.C) were added to the blood samples. The lead existed in the blood samples were measured using atomic absorption spectrophotometric method with flames and applying Smith-Hefty model at the wavelength of 217.4 and the measurement accuracy of 95%. The obtained results were described regarding the considered variables using chi-square test, analysis of variance and least significant difference test (LSD) pre-test at a level of 95% confidence. The experimental group was subdivided into four subgroups; they were compared with each other and with the control group.

RESULTS

In table 1, sex distribution and frequency of children of subjects are presented in terms of the groups under the study. In groups that are more associated with lead, a higher percent of the last child's sex was female. There was a significant correlation between the first child gender distribution in different working groups ($p < 0.035$) and the last child gender distribution ($p < 0.001$). Generally, there was a significant statistical relation between all experimental and control groups considering the distribution of the first ($p < 0.005$) and their last child ($p < 0.001$).

Considering the blood lead levels in different subgroups, the group working in the textile industry had less amount of blood lead and the results of this group had a significant difference with the results of other

Table 1: Distribution of natality, first and last child's sexuality up to the study in the experimental and control groups

Groups under the study		No. of total Children	No. of Boys	No. of Girls	Children sexuality							
					First child				Last child			
					Boy		Girl		Boy		Girl	
					N	%	N	%	N	%	N	%
Experimental groups	Reservoir Unit	16	6	10	2	25	5	62.5	2	25	3	37.5
	Refinery Unit	83	38	45	23	60.5	10	26.3	8	21.1	25	65.8
	Repair Unit	142	57	85	32	61.5	14	26.9	5	9.6	41	78.8
	Tin maker Unit	123	38	85	25	48.1	20	38.5	12	23.1	33	63.5
Total experimental groups	364	139	225	82	54.7	49	32.7	27	18	102	68	
Control group	164	77	87	22	31.4	33	47.1	37	52.9	18	25.7	

Table 2: Blood lead levels (mean ± SD) in the control and experimental groups $\mu\text{gr}/100\text{cc}$

Studied groups	Blood lead (Mean±SD)
Experimental groups	
Reservoir Unit	28.86 ± 2.09
Refinery Unit	31.35 ± 5.31
Repair Unit	33.33 ± 5.99
Tin-maker Unit	40.87 ± 8.04
Total experimental groups	35.20 ± 7.74
Control group	19.61 ± 4.12

Table 3: P-Values of Blood lead differences in the control and experimental groups

	Refinery Unit	Repair Unit	Tin-maker Unit	Control group
Reservoir Unit	<0.276*	<0.046	< 0.001	< 0.001
Refinery Unit	-	<0.114*	< 0.001	< 0.001
Repair Unit	-	-	< 0.001	< 0.001
Tin-maker Unit	-	-	-	< 0.001

* Not Significant

groups ($p < 0.001$). In other experimental subgroups, the group working in the tin maker indicated a significant difference ($p < 0.001$) with other groups (Table 2, 3).

DISCUSSION AND CONCLUSION

As mentioned earlier, lead is a toxic heavy metal that has so many various impacts and complications. Among these effects, its impacts on sexual glands, interference with spermatogenesis, fertility, natality can be mentioned. As extensive studies carried out to examine this issue indicated and as it was noted in the findings of the current study, there is a relation between the blood lead level and distribution and frequency of children's sex. Groups which their blood lead level was higher than the other groups had more female offspring and their last child's sex (up to the study) was female. However, it is known that many factors are involved in determining a child sex; hence, it cannot be conclusively stated that lead had a significant determining role. But, as it can be observed, in the current study, not only there was a relationship

between experimental groups, but also there was a significant relationship between the experimental and control groups in this regard.

In a study, Shiao demonstrated that fertility rate had reduced in workers who were exposed to lead [11]. As it is known, reduction in fertility can be followed with various effects and complications. In another study, Lin *et al.* compared workers exposed to lead with professional bus drivers and concluded that the fertility rate reduced dramatically among workers exposed to lead [12]. He stated that the birth rate among workers exposed to lead was less than the bus drivers. In another study conducted to investigate infertility of males who were exposed to the environmental factors including lead, Benoff *et al.* asserted that lead, due to its accumulation property, affected male reproductive organs such as sex hormones, male fertility and other parameters related to sperm and causes problems which have evident impacts on birth rate [13]. Moreover, Coste, in a cohort type study, examined workers exposed to lead in terms of birth rate and their number of child and stated that workers

whose blood lead levels were higher than the others had fewer children. His criteria for this study were person-year [14]. In another study carried out by Bonde on battery construction workers exposed to lead demonstrated that these workers, due to lead accumulation in their body and sex organs, not only had less sexual intercourse, but also their fertility was reduced and their number of sperms was also affected. Therefore, they had fewer numbers of children and most of their children were female. This was more evident in their last years of producing offspring [15]. Due to its effects on sexual organs, lead can have various kinds of intervention. As it is noted in the current study and other in line studies, it may be concluded that lead can impact the fertility activity and influence the distribution and frequency of offspring sex. However, as mentioned earlier, the distribution and frequency of offspring cannot be only due to the effects of lead since there are several affecting factors in this regard. Many other studies must be conducted to find out the decisive impacts of lead.

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