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The Impact of Lead Contamination on Psychiatric Disorders and Quality of Life

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Abstract

Introduction: The aim of this study was to determine the effect of exposure to lead contaminants on the psychiatric disorders and quality of life in employees of various occupations in Sanandaj city, Iran, where there is lead in the workplace. Method: The present study was a descriptive-analytical study done on employees of different occupations (including: non-exposed people, gas station, welding and painting) in Sanandaj, Iran. 64 people were considered as the non-exposed group, and 124 were selected as the exposed group.To obtain blood sample from the employees, about 7 ml of the blood of each person in the heparin tubes was collected by a sterile disposable syringe, and then, transferred to the laboratory. Blood lead levels were measured by the atomic absorption spectrophotometer apparatus AA6800. A psychiatric disorders' questionnaire (-90Checklist Symptom 90-Scl) was used to assess the psychiatric disorders. The questionnaire contained 90 questions for evaluating the mental symptoms, and the results were reported by the interviewee. In this study, a 36-item quality of life questionnaire (SF-36) with a total of 36 questions in 8 health domains including physical function, physical role, physical pain, general health, energy and vitality, social functioning, emotional-mental problems and mental health was used. After collecting the data, the obtained information was entered to the SPSS software version 20. Results: The age range of the subjects was between 25 and 50 years old. All the subjects were male, and 43% of the exposed group and 37% of the non-exposed group had higher education than diploma. The highest blood lead level was observed for welding staff with an average of 63.3500 µg/dl, and the lowest blood lead level belonged to the subjects without exposure to lead with an average of 14.7500 µg/dl. Moreover, the highest level of quality of life and the lowest levelsof psychiatric disorders were found in non-exposed people, and the lowest level of quality of life and the highest psychiatric disorders were in welding staff. Conclusion: Regarding the problems associated with the exposure to lead, reducing blood lead levels by decreasing the amount of lead in chemicals should be used in various industries, as well as the use of personal protective equipments such as chemical masks are necessary.

Key Words: Blood lead level, Sanandaj, Psychiatric disorders, Quality of life, Occupational exposure.

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Introduction

Lead induced toxicity is an old public health problem in developing countries (Öktem et al, 2004). Lead is one of the most important elements used in the industry which its toxicity is due to the presence of this substance in the environment (Gurer-Orhan, Sabır & Özgüneş, 2004). High concentrations of lead in the environment due to its harmful effects on health and longevity should be considered (Blanusa, 1996). This element is a natural xenobiotic that is present everywhere and can cause many physiological, biochemical and behavioral disorders in humans and animals. Unfortunately, exposure to lead is unavoidable, because the use of this metal in daily life of man exists from workplace to home and accumulates in the environment (Shannon, Borron & Burns, 2007; Malekirad et al, 2011) . Exposure to lead (Pb) is one of the environmental problems all over the world that can lead to an imbalance between the generation and the removal of reactive oxygen species (ROS) leading to many hazardous effects and celldamage (Haroun, et al., 2018). Lead exists in various industries, including battery plant, polishing oil, mining, melting, processing of metals of dye production (Karrari, Mehrpour & Abdollahi, 2012). There are many ways to be exposed to lead, including lead pipelines for drinking water, smoking, air industrial units, food and other factors (Vaglenov et al, 2001). Blood lead level (BLL) is the best indicator for identifying lead exposures which is used for biological monitoring of occupation and industries in lead exposure. There are various ways to measure the exposure of staff to lead, but the BLL indicator is the best way to determine therapeutic measures (Abdollahi, Nikfar & Jalali, 1996).With increasing blood lead level, at first biochemical symptoms occur

and gradually by increasing blood lead level side effects such as disorders of the functioning of the nervous system and the brain, premature birth and weight loss of baby, reversible problems in the kidney, intestinal contraction pain, cardiovascular toxicity, immune system disorders and various cancers, including lung, stomach and bladder cancer whill happen (Weaver et al, 2011). The International Agency for Research on Cancer (IARC) in 2006, categorized the lead in the 2A compound group, that meansit is potentially carcinogenic to humans (Baan, 2010). Regarding the level of lead in human blood, various organizations have noted different threshold. The World Health Organization (WHO) and the National Health and Occupational Organization has authorized threshold limit value (TLV) of lead between 20 and 30 micrograms per deciliter of blood and 40 micrograms per deciliter, respectively (Barbosa et al, 2005).

Psychic health is an aspect of the overall concept of health and it is referred to all methods and measures used to prevent psychic illness, treatment and rehabilitation (Abdol malki et al., 2015). Psychological disorder or psychic illness is a behavioral and psychological pattern that happens to a person and it is accompanied by a disturbance in function due to a biological, social, psychological, genetic, physical or chemical disorder. The psychic disorder is measured according to the severity of deviation from the normal range (Cumbie, Conley & Burman, 2004). Psychic illness, more over to the suffering and limitations that happens to person, it also causes a person to be discriminated against his social and professional activities because of the psychic illness. The impact of psychic disorders on society is important because of their care and physical support and their productivity reduction. The huge burden of treatment, care and the physical and emotional support that the families of the patients have encountered and their economic burden should not be ignored (Ahmadv and et al 2010). The WHO announced that about 45 million people suffered from psychiatric disorders in 2001 worldwide and of each four people, one in some stages of life experiences symptoms of psychiatric disorders (Abedini & Talebi, 2017).

Nowadays, various factors such as industrialization, population growth, urbanization and migrationcan cause stress, social issues and have made major changes in the epidemiology of diseases and the health needs of individuals, so that psychiatric illness is at the top of the causes of inability and early death. The high prevalence of these illnesses and their long-term and chronic disabilities have caused psychiatric problems to be considered as a health priority (Muri & Lopez, 1998; Sayers, 2001). Many studies have been conducted on psychiatric health in Iran, which show that 21% of the population suffer from psychiatric disorders (Nour bala et al, 2002).

As mentioned above, there are many ways to be exposed by lead, one of them is the industry; the level of exposure to lead in the industry is high and bring about the side effects, including the effects of lead on psyche health and psychiatric disorders. Exposure to lead changes neurotransmitter and hormone systems and thus can make an aggressive and violent behavior (Stretesky & Lynch, 2001). Exposure to lead causes increase of oxidative stress and it can lead to various types of psychiatric disorders. This is because of the disturbance of brain function due to the reduction of antioxidant defense against increased lipid per oxidation. According to TR-IV-DSM diagnostic criteria, oxidative stress can lead to mental retardation, autism disorders, attention deficit hyperactivity disorder, delirium, dementia, alcohol-related disorders, amphetamine-related or pseudo-amphetamine disorders, delusional disorders, nicotine-dependent disorders, opioid-related disorders, schizophrenia, mood disorders, anxiety disorders, sexual dysfunction, eating disorders, and sleep disorders (Tsaluchidu et al, 2008). Researchers separately have studied the effects of oxidative stress on any of the psychological disorders. For example, Major Depressive Disorder (MDD) is one of the consequences of increased lipid per oxidation (Shao, Young, & Wang, 2005; Bilici et al, 2001). In a self-care meta-analysis study, 21 cross-sectional studies were performed, and the result showed that self-control reduction is the most important factor in creating criminal behavior (Pratt & Cullen, 2000). In other studies, conducted by Elliott et al (1992), and Needleman et al (2002), a significant negative relationship between exposure to lead and self-control in children was observed (Elliott, 1992; Needleman et al, 2002). In a study by Needleman about exposure to lead and IQ levels, the comparison between exposed and non-exposed groups showed that there is a 4 to 6-point IQ difference between the two groups. Moreover, exposure to lead in addition to reducing IQ, has led to an increase in crime among adolescents (Needleman et al, 2002). According to studies, there is a significant relationship between blood lead levels and anti-social behaviors (Dietrich et al, 2001). Lead is also known as a neurotoxin which affects the anatomy of the brain and nerves in the exposed people (Olympio et al, 2009). Another study of magnetic resonance imaging of brain (MRI) showed that the grey matter of individuals in the exposure to lead has significantly decreased and while the anterior cortex is the controller of commands related to mood (Cecil et al, 2008; Cecil et al, 2010). Of all these claims, there is a relationship between lead exposure, violence, and other psychiatric disorders (Nevin, 2007)). Psychiatric disorders, and especially violence, have a major impact on quality of life and it reduces the quality of life. Quality of life can be related to enrichment of health model of physical activity like personal enjoyment, improved vitality and enhanced mood states (Antony & Azeem, 2019). Quality of life includes the mental, physical, emotional and social feelings of well-being, and reflects patients' mental evaluation of their response to it (Marzangi , et al., 2018). Reading career related domains and managing emotions in social contexts are important for success in a variety of interpersonal as well as career related domains (Valian, et al., 2018). In studies, psychiatric disorders, such as violence and misbehavior, have adverse effects on quality of life parameters such as depression, anxiety, stress, suicide, drug and alcohol consumption, headache and other issues affecting health and the quality of life in general (Wittenberg et al, 2007; Tiwari et al, 2008; Matud, 2007; Eberhard-Gran et al, 2007; Diop-Sidibé et al, 2006; Hegarty et al, 2010). The purpose of this study was to determine the effects of lead on psychiatric

disorders and quality of life in workers exposed to lead in Sanandaj city, Iran.

Method

This study was a descriptive-analytical study in different employees of occupation in Sanandaj (non-exposed people, gas station, welding and painting). Due to the type error of 5% and the study's strength of 90%, for the non-exposed group, 64 and for exposed group 214 workers were selected. Of the exposed people, 64 were gas station's staff (because more people work at gas station) and for each of the other occupations, 30 were considered. The entry criteria for the case group included male gender, age of 25 to 50, and at least two years' work experience. Exit criteria included workers who used chelating agents such as sucrose, $CaNa_2EDTA$, BAL or D-penicillamine, alcohol, cigarettes and drugs for 6 months before taking the blood sample. The control group consisted of non-exposed individuals, who based on demographic data in terms of age, Sex, ethnicity and daily activity were similar to those in the case group. To perform this study, a questionnaire containing information about age, smoking, history of disease, work experience etc. was completed.

Blood sampling:

We used sterile disposable syringe and about 7 ml of blood of each person in heparin tubes was collected by a nurse and then transferred to the laboratory. To determine the amount of lead in blood, 1 ml of the blood sample was transferred to a 10 ml polystyrene tube and then digested with 0.5 ml of concentrated nitric acid and kept at 30 °C to dry, and mixed with distilled water and then filtered with Wattman filter paper. The AA6800 atomic absorption spectrophotometer was used to estimate blood lead levels.

Questionnaire:

Psychiatric Disorders Questionnaire:

Data on work experience, socioeconomic status (income, education and lifestyle, smoking, alcohol, medication and vitamin or antioxidant supplementation and diet) were collected by questionnaires and trained interviewer interviewed each individual worker. Psychiatric disorders questionnaire (90-Checklist Symptom 90-Scl) was used to assess psychiatric disorders. The questionnaire contains 90 questions for assessing psychological symptoms and is reported by the interviewer which at first, was introduced to show the psychological aspects of physical and psychiatric patients. Using this questionnaire, healthy people can be distinguished from the patient. Each question of questionnaire made of a 5-degree range of discomfort, which consists of a zero score "nil" to four "severely". The questions of the questionnaire consist of nine different dimensions including physical complaints, obsessive-compulsive and sensitivity to interpersonal relationships, depression, anxiety, aggression, phobias, paranoid thoughts, and psychosis. This questionnaire has a high validity and authority (Malekirad et al, 2011). In Symptom Checklist-90-Revised (SCL-90-R) respondents answer 90 questions in the 5-point Likert scale. This scale consisted of nine dimensions of body building (12 items), obsessive-compulsive (10 items), interpersonal sensitivity (9 items), depression (13 items), anxiety (10 items), hostility (6 items), anxiety (7 items), Paranoid thoughts (6 items), psychosis (10 items) and 7 additional items that are not included in any of the nine dimensions and some of them measure the sleep disturbance and sexual dysfunction. The Symptom Checklist 90 in many studies has been used as a brief indicator of mental health (Koh, Kim & Park, 2002). Dragothis (1994), while verifying the internal consistency of the scale, reported a retest reliability between 0.77 and 0.90 (Derogatis, 1975). In the study by Biabangard and Javadi (2004), the internal consistency of the scale was reported to be between 0.88 and 0.90 (Biabangard et al, 2004). The score of each subscale is obtained by adding the scores of its items from the subscale divided by the number of its subscales. The scores obtained are interpreted as follows:

- Average scores of one or higher: morbidity status
- Average scores higher than 3: Schizophrenia
- Note: In a subscale of depression, a score above three usually indicates severe depression and psychosis.
- Note: scores of 2.5 and higher than 2.5 are considered as mental status.

Quality of Life Questionnaire:

In this study, a 36-item quality of life questionnaire (SF-36) with a total of 36 questions in 8 health domains including physical function, physical role, physical pain, general health, energy and vitality, social functioning, emotional-mental problems and mental health, have been used. The SF36 domains, with the questions reviewed in the questionnaire, deal with a rating scale. This scale includes scores from zero to 100. For each domain, the zero score represents the worst case and the hundredth score represents the best possible status. Therefore, the scores above 50%, show an appropriate quality of life and below 50%, show inappropriate quality of life.

Validity and reliability of the questionnaire:

In a study by Kaldi A (2014), to determine the validity of the questionnaire, factor analysis and group differences were used (KALDI et al, 2014). The results showed that the test consists of seven factors and the commonalities of questions (the correlation of each single question with the overall concept, in other hand responsibility) was between 48% and 78%, and was mostly high. Structural validity through group differences was also performed on two groups with high and low responsibility, using t-tests for independent groups which showed significant differences in all of the seven factors mentioned, so that, the researcher's test of responsibility can well differentiate between these two groups and it has been a highly structural validity.

In the study by Kaldi A (2014), the reliability of the questionnaire was evaluated using internal consistency statistical analysis and

test validity using the comparing known groups method and convergent validity. Internal consistency analysis has shown that the persian SF36 scale has a minimum standardized reliability coefficient ranging from 0.77 to 9.0 (KALDI et al, 2014).

Statistical analysis:

After collecting data, the information was entered to the SPSS software version 20 and according to the objectives of the study, for the descriptive-qualitative purposes the frequency and their percentage were calculated. For descriptive-quantitative variables, mean and standard deviation were calculated. For analytical purposes, after reviewing normal and non-normal quantitative data, for normal data, appropriate parametric tests (T-test, ANOVA) and for non-normal data non-parametric tests have been used (Mann-Whitney, Kruskal-Wallis). Chi-square test was used to analyze the two-quality qualitative data.

Due to the type error of 5% and the study strength of 90%, for the non-exposed group, 64 people and for the exposed group, 214 were selected. Of the exposed people, 64 were gas station's staff (because more people work at gas station) and for each of the other occupations, 30 were considered. The age range of participants was between 25 and 50 years. All participants were male and 43% of exposed group and 37% of non-exposed group had education higher than diploma. Blood lead levels, parameters of psychiatric disorders, quality of life, and the other measured parameters has been shown in table (1). As shown in table (1), the highest blood lead level was observed for welding staff with an average of 63.3500 µg/dl and the lowest blood lead level belongs to subjects without exposure to lead with an average of 14.7500 µg/dl. In addition, the highest level of quality of life and the lowest level of psychiatric disorders were found in non-exposed people and the lowest level of quality of life and the highest psychiatric disorders were in welding staff.

Results:

Table 1- Blood lead levels, parameters of psychiatric disorders and quality of life

parameters		1*	2*	3*	4*	5*	6*	7*
Blood lead (µg/dl) level	**average**	14.7500	37.4375	63.35	49.600	35.6167	20.3167	49.3833
	Std. deviation	3.61654	3.93952	4.60912	19.2740	5.14226	8.75577	11.7000
lead level in ($\mu g/m^3$) the air	**average**	16.5156	39.5938	66.4500	52.3667	37.7667	22.4333	56.7000
	Std. deviation	4.02765	4.18887	5.34556	18.4362	4.39187	8.31257	16.7890
physical complaint	**average**	0.9656	2.2828	2.3733	1.7767	1.6167	1.1567	2.2067
	Std. deviation	0.33863	0.68233	0.71193	0.63174	0.49416	0.3802	0.84182
obsessive-compulsive	**average**	0.6188	1.7594	2.4733	2.21000	1.6500	0.9000	2.3467
	Std. deviation	0.17717	0.45451	0.56625	0.91363	0.33810	0.33114	0.53352
interpersonal sensitivity	**average**	0.6828	1.8000	2.4200	2.2133	1.6333	0.9067	2.3400
	Std. deviation	0.25106	0.40316	0.66561	0.91942	0.49434	0.33726	0.52233
depression	**average**	0.7031	1.7891	2.4767	2.2000	1.6767	1.0000	2.3367
	Std. deviation	0.19758	0.42506	0.57336	0.95254	0.43761	0.25325	0.51761
anxiety	**average**	0.6859	1.9109	2.4800	2.2130	1.6633	1.0533	2.4200
	Std. deviation	0.24616	0.50367	0.6008	0.9200	0.49653	0.4305	0.59097
aggression	**average**	0.9797	2.3641	2.5433	1.9300	1.6833	1.1333	2.2167
	Std. deviation	0.32278	0.58861	0.54689	0.6309	0.46541	0.37723	0.72544
phobias	**average**	0.6672	2.0688	2.2967	1.6800	1.4500	0.9167	2.0000
	Std. deviation	0.34963	0.6034	0.57804	0.69451	0.47179	0.4480	0.77904
Psychosis	**average**	0.6719	1.7984	2.4933	2.1067	1.6500	0.9867	2.3467
	Std. deviation	0.22358	0.4890	0.58365	0.91536	0.33810	0.25152	0.53352
Physical pain %	**average**	78.0156	51.9531	30.1667	39.5000	55.6667	71.5000	42.3333
	Std. deviation	10.1081	10.0244	6.88368	14.7178	11.1983	14.2120	12.9144
general health%	**average**	76.2969	50.3906	33.3333	42.8333	60.0000	66.1667	46.0000
	Std.	12.6687	11.17341	6.34270	16.3308	14.1421	16.0647	17.4889

	deviation							
vitality%	**average**	77.8594	52.2656	40.5000	41.6667	58.3333	67.8333	39.1667
	Std. deviation	11.5096	9.67445	12.8887	16.459	14.4038	15.4073	17.7182
Social Performance %	**average**	78.2500	53.6719	31.3333	37.5000	57.1667	71.3333	46.8333
	Std. deviation	9.89468	9.09571	2.91646	13.5028	7.50670	15.4212	11.9973
mental problems%	**average**	76.9219	52.6563	30.8333	37.0000	52.6667	73.1667	38.5000
	Std. deviation	12.3330	9.03998	2.30567	13.7464	5.37127	11.9973	14.1513
mental health %	**average**	75.9844	51.5625	33.8333	43.6667	56.1667	68.3333	41.3333
	Std. deviation	12.6032	10.9063	9.25532	14.9096	7.62068	18.8155	14.3198

1 * = non-exposed, 2*=gas station, 3*=welding, 4*=car repair shop 5*=battery plant, 6*=printing and duplicating 7*=painting

According to table (1), the blood lead levels in the welding, battery plant, painting, gas station, mechanical, printing and duplicating, and non-exposed individuals were from the highest to the lowest, respectively.

According to table (2), there is a significant positive relationship between blood lead level and psychiatric disorders ($p < 0.05$). As the blood lead level increased, the level of psychiatric disorders also increased. There was also a significant negative relationship between blood lead level and quality of life parameters, so that, the quality of life decreased with increasing blood lead levels ($p < 0.05$). The relationship between the concentration of lead in the air and blood lead levels was significantly positive and with increasing the concentration of lead in the air, blood lead levels increased ($p < 0.05$).

Table 2- Relationship between bloods lead level withpsychiatric health parameters, quality of life, the concentration of lead in the air

exposure	Blood lead	Correlation Coefficient	Sig. (2-tailed)	N
	Lead in the air	0.979	p<0.05	278
Psychiatric disorders	physical complaint	0.802	p<0.05	278
	Obsessive-compulsive	0.963	p<0.05	278
	Interpersonal sensitivity	0.935	p<0.05	278
	depression	0.930	p<0.05	278
	anxiety	0.907	p<0.05	278
	aggression	0.848	p<0.05	278
	phobias	0.857	p<0.05	278
	psychosis	0.943	p<0.05	278
Quality of life	Physical pain	-0.799	p<0.05	278
	Public health	-0.691	p<0.05	278
	vitality	-0.669	p<0.05	278
	Social performance	-0.817	p<0.05	278
	Mental problems	-0.825	p<0.05	278
	Mental health	-0.724	p<0.05	278

Table 3- Assessment of psychiatric disorders among different employees, based on the number of people in each occupation

parameters	**psycho status**	**1***	**2***	**3***	**4***	**5***	**6***	**7***	**total**	
									number	**percentage**
physical complaint	**healthy**	32	4	0	3	3	10	1	53	19.06
	morbid conditions	32	48	23	25	27	20	23	198	71.22
	Schizophrenia	0	12	7	2	0	0	6	27	9.712
Obsessive-compulsive	**healthy**	59	1	0	2	0	16	0	78	28.06
	morbid conditions	5	63	24	20	30	14	28	184	66.19
	Schizophrenia	0	0	6	8	0	0	2	16	5.75
Interpersonal sensitivity	**healthy**	53	0	0	2	3	16	0	74	26.62
	morbid conditions	11	64	24	20	27	14	28	188	67.62

	Schizophrenia	0	0	6	8	0	0	2	16	5.75
depression	**healthy**	57	0	0	2	0	15	0	74	26.62
	morbid conditions	7	64	24	20	30	15	28	188	67.62
	Schizophrenia	0	0	6	8	0	0	2	16	5.76
anxiety	**healthy**	53	0	0	2	0	16	0	71	25.54
	morbid conditions	11	62	24	20	30	14	25	186	66.90
	Schizophrenia	0	2	6	8	0	0	5	21	7.53
aggression	**healthy**	32	0	0	0	2	10	0	44	15.83
	morbid conditions	32	52	24	28	28	20	24	208	74.82
	Schizophrenia	0	12	6	2	0	0	6	26	9.35
phobias	**healthy**	47	3	0	4	4	18	4	80	28.77
	morbid conditions	17	61	25	25	26	12	21	187	67.26
	Schizophrenia	0	0	5	1	0	0	5	11	3.96
psychosis	**healthy**	54	1	0	2	0	15	0	72	25.90
	morbid conditions	10	62	24	20	30	15	28	189	67.98
	Schizophrenia	0	1	6	8	0	0	2	17	6.12

1 * = non-exposed, 2*=gas station, 3*=welding, 4*=car repair shop 5*=batteryplant , 6*=printing and duplicating, 7*=painting

According to table (3), the number of employees with healthy, morbidity status and Schizophrenia, was determined for each of the parameters of psychiatric disorders in each occupation. For example, in the job number (3*) that is welding, in the physical complaint parameter, no person was healthy, 23 have low physical complaints (morbid conditions) and 7 have severe disorders (Schizophrenia).

Table 4- Assessing the quality of life in different occupation employees based on the number of people in each occupation

parameters	**Quality of life**	**1***	**2***	**3***	**4***	**5***	**6***	**7***	total	
									number	percentage
Physical pain	**appropriate**	62	44	2	8	27	28	8	179	64.39
	Inappropriate	2	20	28	22	3	2	22	99	35.61
Public health	**appropriate**	61	44	3	10	30	25	14	187	67.27
	Inappropriate	3	20	27	20	0	5	16	91	32.73
vitality	**appropriate**	61	46	12	10	27	26	8	190	68.34
	Inappropriate	3	18	18	20	3	4	22	88	31.66
Social performance	**appropriate**	62	52	0	6	30	29	14	193	69.42
	Inappropriate	2	12	30	24	0	1	16	85	30.58
Mental problem	**appropriate**	61	46	0	3	27	30	6	173	62.23
	Inappropriate	3	18	30	27	3	0	24	105	37.77
Mental health	**appropriate**	61	46	4	10	30	25	8	184	66.19
	Inappropriate	3	18	26	20	0	5	22	94	33.81

1* = non-exposed, 2*=gas station, 3*=welding, 4*=car repair shop, 5*=battery plant, 6*=printing and duplicating, 7*=painting

According to Table 4, the number of employees who were inappropriate in each of the parameters of quality of life, was determined. For example, in the employees of the group (3*), two employees had favorable conditions for physical pain and 28 of these employees were in bad physical conditions.

Discussion

In the present study, the average blood lead level in non-exposed groups, gas station workers, welder, battery plant workers, mechanics, printing and duplication and painter was 0.00 µg/dl, 14.75, 37.4375 µg/dl, 63.3500 µg/dl, 49.6000 µg/dl, 35.6167 µg/dl, 20.3167 µg/dl, 49.3833 µg/dl, respectively. Thus, the lead level of non-exposed individuals, gas station workers, mechanics and printing industry was so high that it requires individual management, including clinical measures. According to the

OSHA standard, the blood lead level of battery plant workers and painting industries workers is so high that it requires rapid measures and the lead level of the welder is so much that it requires actions such as releasing from the work (CSEM, 2010). According to a review study carried out by Sayehmiri et al. in 2016, the blood lead levels in workers at the gas station, welder, battery maker, mechanic, printing and duplicator were 30.05 µg/dl, 67.02 µg/dl, 43.3 µg/dl, 38 µg/dl, 13.63 µg/dl, 47.84µg/dl, respectively. Therefore, the blood lead levels in various occupations with blood lead levels in the study by Azami et al. were approximately similar and there was little difference (Sayehmiri et al, 2016). In addition, between the exposed industries in this study, the average blood lead in the weld industry was higher and in the printing and duplication industry was lower than the rest of the industries. The high level of lead in the welding can be due to metallic vapors from galvanized sheet welding, welding of sheets with silicate zinc coatings, indoors places, and lack of suitable ventilation (Shahrabi et al, 2006).

There was a significant relationship between blood lead level and air lead level ($p < 0.05$), so that, the more lead in the air, the more blood lead levels, too. A study conducted by Bahrami et al .(2002), a significant relationship was observed between the concentration of lead and blood lead levels ($p < 0.05$) (Bahrami, Mahjub & Assari, 2002). Also, there was a significant positive relationship between blood lead level and psychiatric disorders ($p < 0.05$), so that, with increasing blood lead levels, the level of psychiatric disorders increased, including physical complaints, compulsive-obsession, interpersonal sensitivity, depression, anxiety, aggression, phobias, and psychosis. Relationship between blood lead level and quality of life parameters was significantly negative ($p < 0.05$), so that, with increasing blood lead levels, quality of life parameters including physical pain, general health, vitality, social performance, mental problems and mental health decreased. For confirming the results of this study, the following studies from various researchers over the years can be noted. According to study carried out by Stretesky et al. in 2001, there was a close relationship between lead and crime (Stretesky & Lynch, 2001). Also, in other studies including Mahaffey et al. (1982), and Needleman et al. (2002), the relationship between lead and quality of life indicators and other social indicators was found (Needleman et al, 2002; Mahaffey et al, 1982; Needleman, 1990; Decker & Wright, 1997). In another study carried out by Boutwell et al. in 2016, the strong influence of lead on social behaviors was proven (Boutwell, et al, 2016). Various studies have been determined that the more blood lead levels the more lipid per oxidation levels, and increasing the levels of lipid per oxidation have caused a variety of psychiatric disorders such as obsessive-compulsive disorder, severe anxiety syndrome, helplessness, and excessive alcohol consumption (Ersan et al, 2006; Chakraborty et al, 2009; Ozdemir et al, 2009; Ratnakar et al, 2008). In another study by Forlenza et al in 2006, damage to DNA caused anxiety disorders (Forlenza & Miller, 2006). The results of this study are similar to studies conducted by Ersanet al. (2006), and Chakraborty et al. (2009), Ozdemir et al. (2009), Ratnakar et al. (2008), and Forlenza et al. (2006). In these studies, the effect of lead on various social parameters, psychiatric disorders and quality of life was proven (Ersan et al, 2006; Chakraborty et al, 2009; Ozdemir et al, 2009; Ratnakar et al, 2008; Forlenza & Miller, 2006). Abdolmalki et al in 2009, found that workers who were exposed to lead, have more psychosocial and physical problems in all of the measured scales including physical symptoms, anxiety, social dysfunction, depression, and other cases relative to non-exposed people such as administrative staff (Abdolmalki et al, 2009). In a self-care meta-analysis study, which summarized 21 cross-sectional studies, it was concluded that self-control reduction is the most important factor in developing criminal behavior. In other studies conducted by Elliott et al. (1992), and Needleman et al. (2002), there was a significantly negative relationship between exposure to lead and self-control in children (Abdolmalki et al, 2009; Elliott, 1992) . In a study carried out by Needleman about exposure to lead and IQ levels, the comparison between exposed and non-exposed groups showed that there is a 4 to 6-point IQ difference between the two groups. Moreover, exposure to lead in addition to reducing IQ, has led to an increase in crime among adolescents (Needleman et al, 2002). According to studies, there is a significant relationship between blood lead levels and anti-social behaviors (Dietrich et al, 2001). Lead is also known as a neurotoxin which affects the anatomy of the brain and nerves in the exposed people (Olympio et al, 2009). Another study of magnetic resonance imaging of brain (MRI) showed that the grey matter of individuals in the exposure to lead has significantly decreased while the anterior cortex is the controller of commands related to mood (Cecil et al, 2008; 2010). Of all these claims, there is a relationship between lead exposure, violence, and other psychiatric disorders (Nevin, 2007). Psychiatric disorders, and especially violence, have a major impact on quality of life and it reduces the quality of life. In some studies psychiatric disorders, such as violence and misbehavior, have adverse effects on quality of life parameters such as depression, anxiety, stress, suicide, drug and alcohol consumption, headache and other issues affecting health and the quality of life in general (Wittenberg et al, 2007; Tiwari et al, 2008; Matud, 2007; Eberhard-Gran, 2007; Diop-Sidibé, Campbell & Becker, 2006; Hegart et al, 2010).

Conclusion

Considering the high level of blood lead in comparison with the threshold limit, and a significant relationship between the disorders and blood lead level, as well as high psychological problems and low quality of life in staff exposed to lead, reducing blood lead levels by decreasing the amount of lead in chemicals used by various industries, through the replacement of lower toxicity materials, as well as the use of personal protective equipment such as chemical masks is essential.

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