Al-Kufa University Journal for Biology / VOL.8/ NO.2/ Year: 2016
Print ISSN: 2073-8854 & Online ISSN: 2311-6544

Accumulation of Heavy Metals Nickel chloride(II) and potassium dichromate (VI) in the Male Mice for Different Organs and Its Effects on Absolute Weights

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Abstract: Among the hazard of different heavy metals Cr and Ni consider the serious dangers because it's very stable and persistence in the environment causing many alterations in the target tissue such as immunotoxicity, hematoxicity, genotoxicity and neurotoxicity. Forty two mice divided into seven groups each one contain six animals. One group was untreated received tap water as control the other groups received different concentration from $NiCl_2$ (II) and $K_2Cr_2O_7$ (VI). The present study showed that the accumulation of heavy metals ($p \leq 0.05$) and the absolute weights ($p \leq 0.01$) of different organs were significantly decreasing proportional with concentration as compared with the control group.

Introduction:

Heavy metals are chemical elements have specific weights more than 5 g/cm^3 (Mukesh *et al.*, 2008). In the recent years great increase of heavy metal concentration resulted from the industrial revolution and technological progress and great increase in the uses of this metal especially in the industrial ,medicine and agricultural sectors since past few decades (Vinodhini and Narayanan,2009). Heavy metals are very stable and persistent in the environment therefor it considers the major environmental problem that facing the modern world (Parthipan and Muniyan, 2013; Tikare *et al.*, 2012). Heavy metal occur naturally in the environment and found in vary level, the source of its contamination result from either natural or anthropogenic activities (Gathwan *et al.*, 2012). Chromium (Cr) found in many oxidation state but, Cr (VI) is widespread used in an industrial process (Jeber and Tawfeek, 2012). Cr (VI) can cause skin, lung and throat cancer, DNA damage, infertility and increase the portion of birth (Blacksmith institute, 2007). Nickel is very hazard environmental pollution and has harmful effects on human and animal's health (Samir *et al.*, 2012). Nickel was responsible for many toxic effects on the tissue organs and causes many defects such as infertility, sever kidney and liver damage by change several enzymes (Sunderman *et al.*, 1976). Nickel can penetrated all organs in the body after taken then accumulation primarily in bone, liver, kidney and testis (ATSDR, 2003).Nickel has harmful effects on the body by formation free radicals and increase lipid peroxidation in the cells (Sunderman *et al.*, 1976). Bioaccumulations is the process by which the concentration of element in an organs become higher than its concentration in the environments and this causes many histological and biochemical alteration finally lead to high rate of mortality (Ramoliya *et al.*,2007; Fatima, 2008). Heavy metals can absorb and then bioaccumulation in the different organs in which build up in the body (Josthna *et al.*, 2012).

Material and methods:

The mice were housed in plastic cages measuring 30×12×11 cm. under control temperature, 22±2 Cº, at (12) hours light and (12) hours dark cycles. Forty two male mice were randomly divided into seven equal groups each comprising of 6 animals. The first group was kept as negative control; the mice were received tap water without any treatment. The animals of test group were exposed to different sub-lethal concentrations of nickel chloride (20, 40 and 60 mg/kg) and potassium dichromate (VI) (20, 60 and 100 mg/kg) via drinking

water. The experiment was lasted for six weeks, at the end of experiments, animals anesthetized with (chloroform) to open abdomen and remove different body organs (lung, heart and spleen) these organs were washed in water twice then dried and weighted by using electronic balance to obtain absolute weight. Then heavy metal extraction from organs by (Rompe, 1982).

Statistical Analysis

The data obtained from the control and experimental groups were subjected to determine the level of significance at exposure periods by least significant differences (LSD).

Results

High significant differences ($p \leq 0.01$) in the absolute heart weights of mice treated with different concentrations of Cr (VI) as compared with control group figure (1) the same results obtain for absolute lungs and spleen weight (Figure 2,3). The results also showed high significant differences ($p \leq 0.01$) in the absolute heart weights of mice treated with different concentration of Ni (II) as compared with control group (Figure 4), no any significant differences in the absolute weights of lung between the intermediate or high dose, but these doses are significantly different from both lowest dose ($P \leq 0.01$) and the control group (Figure 5). Data in figure 6, revealed no any significant differences in the absolute weights of spleen among the doses, also no significant differences absolute weights of spleen between all these doses as compared to the control group.

The accumulation of heavy metal Cr (VI) was highly significant ($P \leq 0.05$) in the heart and spleen organs for all doses. The effects of these doses on these tissues were revealed that the high dose was more effective ($P \leq 0.05$) than other for all studied organs as compared with the control group (Table 1).However the accumulation of the heavy metal Ni (II) showed no any significant differences among the doses, but the effects of these doses on these organs were revealed that the high dose was more effective ($P \leq 0.05$) than other for all studied tissues as compared with the control group (Table 2).

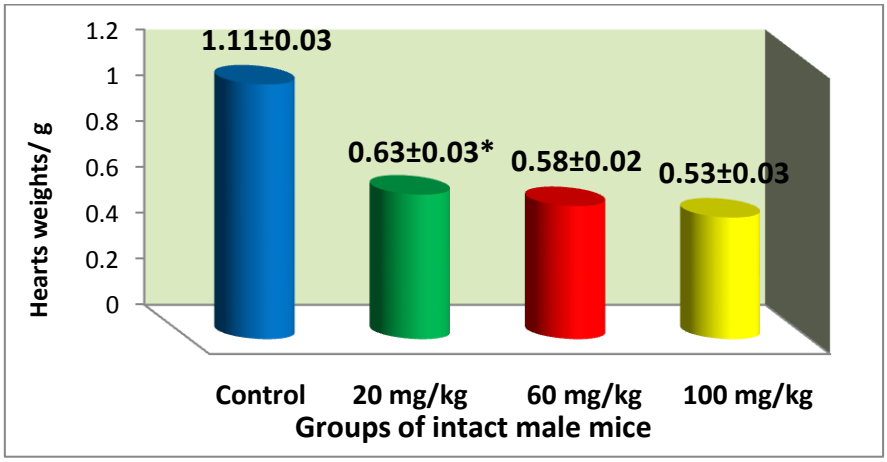

Figure (1): Showed the effects of different doses of Cr (VI) on the absolute hearts weights of mice.

* Significant differences ($P \leq 0.01$, LSD=0.09).

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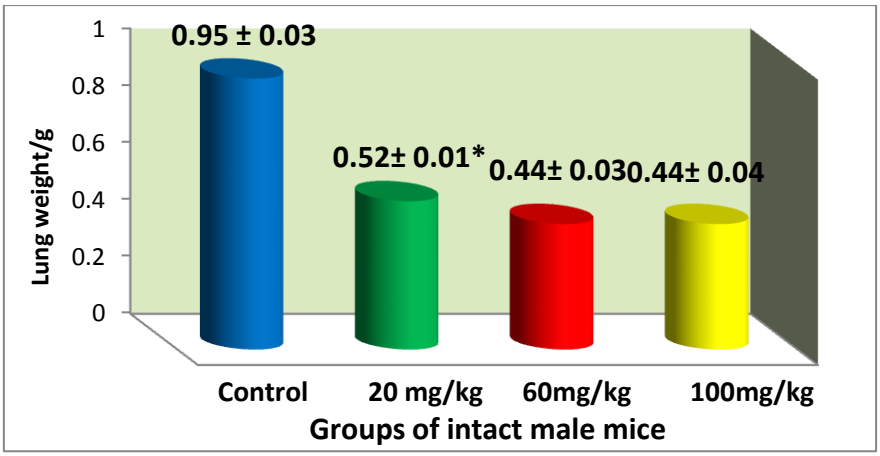

Figure (2): Showed the effects of different doses of Cr (VI) on the absolute lungs weights of mice.

* Significant differences (P≤0.01, LSD=0.09)

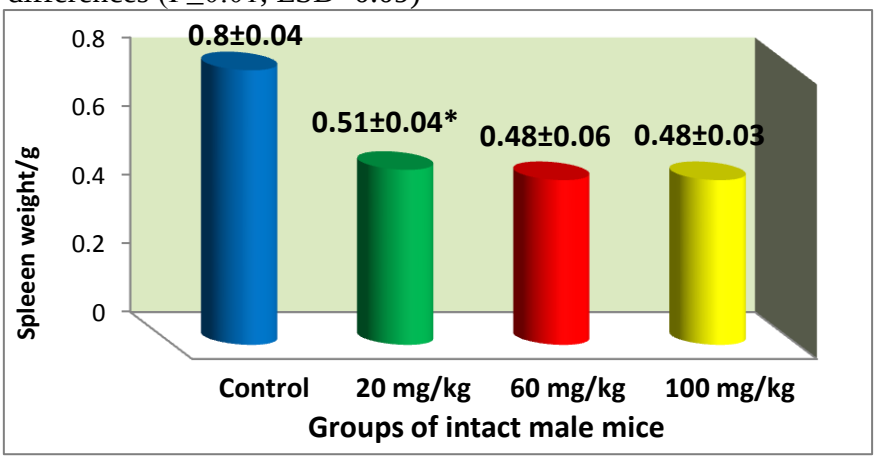

Figure (3): Showed the effects of different doses of Cr (VI) on the absolute spleen weights of mice.

* Significant differences (P≤0.01, LSD=0.13).

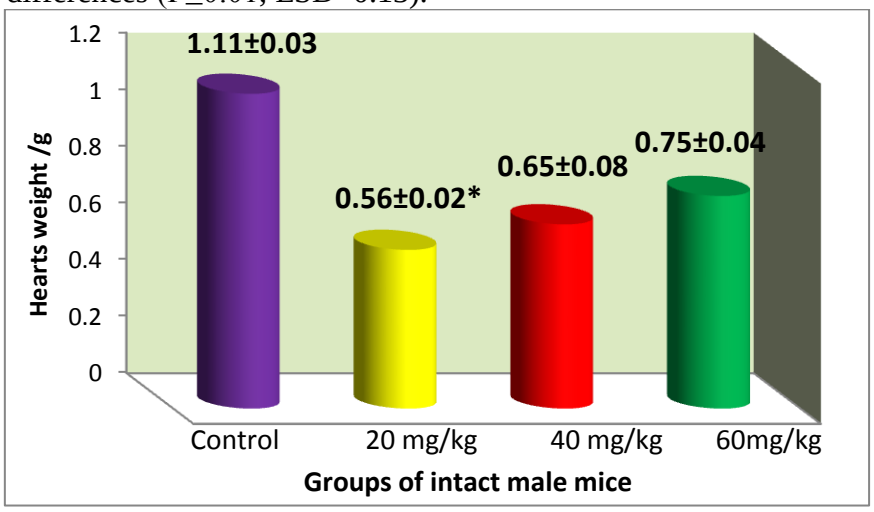

Figure (4): Showed the effects of different doses of Ni (II) on the absolute heart weights of mice.

* Significant differences (P≤0.01, LSD=0.15).

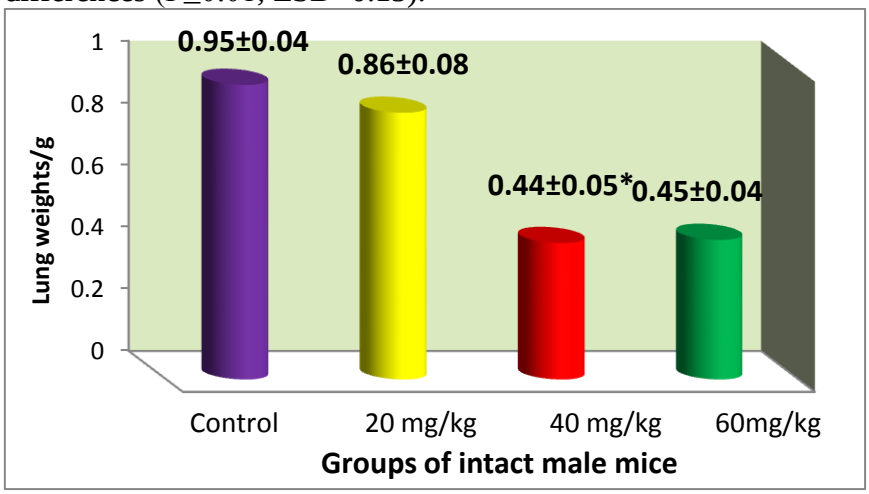

Figure (5): Showed the effects of different doses of Ni (II) on the absolute lung weights of mice.

* Significant differences (P≤0.01, LSD=0.16).

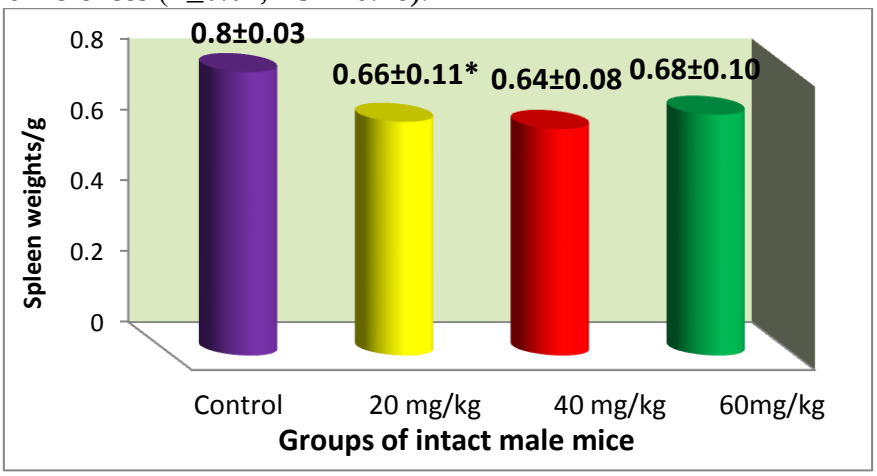

Figure (6): Showed the effects of different doses of Ni (II) on the absolute spleen weights of mice.

* Significant differences (P≤0.01, LSD=0.26).

Table (1): Accumulation of potassium dichromate (VI) in different tissues at different doses.

Doses Mg/kg	Accumulations inside Organs (µg/gm.)			LSD for organs*
	hearts	Lungs	Spleen	
20	3.57 ± 19.063	1.93 ± 15.035	4.74 ± 23.954	8.012
60	2.87 ± 27.458	0.73 ± 23.143	6.77 ± 43.021	
100	5.39 ± 36.125	1.53 ± 34.621	14.23± 57.667	
Control	4.09 ± 6.946	0.49 ± 6.097	4.27 ± 12.613	

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LSD for doses*	**9.251**	

* Significant differences (P≤0.05) of $Cr_2Cr_2O_7$(VI) among different organs.

* Significant differences (P≤0.05) of $Cr_2Cr_2O_7$(VI) among different doses.

Table (2): Accumulation of Nickel chloride (II) in different tissues at different doses.

Doses Mg/kg	**Accumulations inside Organs (µg/gm.)**			**LSD for organs***
	hearts	**Lungs**	**Spleen**	
20	**4.93 ± 21.25**	**5.00 ± 24.188**	**5.21 ± 18.075**	**9.200**
40	**5.41 ± 34.792**	**4.03 ± 33.563**	**3.45 ± 26.208**	
60	**9.54 ± 51.75**	**8.48 ± 39.583**	**11.82 ± 49.625**	
Control	**4.12 ± 10.833**	**1.78 ± 7.663**	**4.67 ± 9.513**	
LSD for doses*	**10.624**			

* Significant differences (P≤0.05) of $NiCL_2$(II) among different organs.

* Significant differences (P≤0.05) of $NiCL_2$(II) among different doses.

Discussion:

In the present study the absolute weights of organ for male mice received different doses of $NiCl_2$ and $K_2Cr_2O_7$ began to decreased significantly (P≤0.01) as compared to the control group. This decrease in the absolute organ weight may be explained according to anorexia result from digestive disorder and finally loss weights. Another reason for this decrease may be due to loss of total body weights. These findings are in agreement with finding by Samir *et al*., (2012), who noticed that significant decrease in body weights gain in male rats received 80 mg/l of $NiCl_2$ via drinking water, and this may be due to the toxicity of metal that causes degeneration of lipids and proteins in the body. Amjad *et al*., (2013) decrease in organ weight of male rat received 8mg/kg of lead acetate due to the decreased muscle mass result from oxidative stress. This result in agreement with (Samir and Zine, 2013) found decrease in absolute and relative weights of liver rat treated with Ni element because it prevents other important element and enzyme important for growth and developments. Another study demonstrated that decrease in weights of livers and lungs of male rats received (0.5, 1 and 1.5 mg/kg) mercury chloride by intraperitoneal injection and this decrease closed relation with increased dose, and this may be due to degeneration of cell resulted from oxidative stress and formation free radicals (Al- Alwany, 2011; Hussein *et al.*, 2011; Grosicki and Kowalski, 2002; Amjad *et al.*, 2013). The present data in agreement with Al- Hamdany, (2010) who demonstrated that significant decrease in the absolute weights of livers, kidneys and spleen organ of male rats received (10, 20, 30 and 40 mg/kg) of lead acetate by intragastric

intubation this caused by degeneration, necrosis and apoptosis in the cells of these organs. About the accumulation of heavy metals the results showed significant accumulation ($P \leq 0.05$) of metals in spleen, hearts and lungs respectively (Table 1,2) and the accumulation showed directly proportional with concentration of doses as compared to the control group. This accumulation can be attributed to increased rate of uptake due to increase metabolic rate then heavy metals are rapidly absorbed and accumulate within different organs. Another explanation may be due to high level of protein-thiol (-SH) groups in these organs and this groups make strong linked with heavy metals. The present study is in agreement with the findings of Blagojević *et al.,* (2012) recorded that high accumulations of Mn, Cd, Fe and Ni elements in liver of the newborn of black- mouse strain found in polluted area with these metals. AL-Taee, (2005) demonstrated high accumulated occur in livers and kidneys of rabbits when received (3, 6, 9 ppm) of $CdCl_2$. Tandon *et al.,* (1996) found high accumulation of Ni element in hears, kidney and liver of male rats when treated with1.5 mg/kg of nickel sulfate for 30 days. (49تر) demonstrated high accumulation in the liver, kidney and testis organs of albino rats when treated with different concentration of lead and cadmium elements. The present study in agreement with (Murthy *et al.,* 2013*)* who found high concentration of selenium in brain, liver, kidney and testis of albino male mice.

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