Some hematological and biochemical effects of potassium permanganate ($KMnO_4$) on female mice (*Mus Musculus L.*).

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Abstract

Potassium permanganate ($KMnO_4$) is a strong oxidant salt that is used to dissolve organic material found in water. To study the effect of (KMnO4) on some physiological parameters in mice (*Mus Musculus L.*). Twenty four female mice were subdivided into three groups, one as control group that received intrapretonial 0.1 ml of distilled water , and two treatment groups, one received 0.25 mg and the other received 0.50 mg per mice of (KMnO4) daily during two weeks. Blood parameters (PCV,Hb,RBC,WBC) showed significant decrease ($P<0.01$) when compared with control group.

On the other hand, the study of biochemical parameters showed significant increase($P<0.01$). in GOT , and significant decrease($P<0.01$) in GPT , and alkaline phosphates , while no effect appeared in RBS , Blood urea , and serum creatinine when compared with the control group ($P<0.01$).

Key words :- Blood parameters, Potassium permanganate, GOT, GPT, Biochemical parameters.

Introduction

Potassium permanganate ($KMnO_4$) is a strong oxidant salt used in combination with other treatment technologies to dissolve specific water treatment problems caused by organic and inorganic contamination in both ground and surface water supplies[1]. It is highly reactive under the condition found in the water industry by oxidizing, a wide variety of inorganic and organic substances [2], while it reacts violently with hydrogen peroxide and with concentrated hydrogen halide and other concentrated acids [3]. In this salt manganese is in +7 oxidation state , and this salt dissolve in water to give deep purple solution[4] . Potassium permanganate is a manufactured on a large scale due to its manifold uses in the laboratory, in the first stage manganese dioxide in its natural form is fused with potassium hydroxide and heated in air to form potassium manganate before electrolytic in alkaline solution to give potassium permanganate [5]. Potassium permanganate is not yet approved by the U.S. food and drug administration because more information is needed on the environmental risk of ($KMnO_4$) exposure [6].

Studies the effects of ($KMnO_4$) on experimental animals suggested that dilute solution is irritant and concentrated solutions is caustic to the skin , eyes , and respiratory tract , inhalation high concentration of dust or mist may cause pulmonary edema in extreme exposure , also it may cause liver and kidney damage after injection [7]. Other studies advised that ingestion of potassium permanganate may cause severe burns to mucous membrane of the mouth , throat , esophagus and stomach [8]. Chronic ingestion or inhalation of potassium permanganate may cause manganese poisoning [9] and the toxicity of it make the patient suffering from emesis , profuse salvation , rapid respiration and albuminuria [10]. Toxic effect in animals exposed to manganese compounds showed increase incidence of pneumonia among rats exposed two weeks to manganese dioxide[11] .Chronic exposure to potassium permanganate affected by CNS included sluggishness , sleepiness , and weakness in the legs [12] . So this study points the effect of ($KMnO_4$) in some physiological parameters of mouse.

Materials and methods

Test material :- Potassium permanganate powder (500mg) product of (Tomes Peaker Company Ltd India) were brought from the local market and stored in the laboratory to be used in experimental methods . This powder was dissolved in distilled water (10ml) to obtain a concentration of (50mg/1ml) and according to the primary test on the experimental animals . This concentration was diluted in distilled water , so the dose which has been used as 0.25 mg and 0.50 mg per body weight of mouse .

Animals :- Twenty four adult female mice of (*Mus Musculus L.*) weighing (22-25 gm) were used for this study obtained from the animals house of the Department of Biology , Education college . They were kept in standard diet and water for 14 days at room temperature (25 ± 3^{o} c) with a 12 h dark and 12 h light cycle .

Experimental designs :- After adaptation period for a week , the twenty four female mice were randomly divided into three groups , a control group and two treatment groups. Each mice in the treatment group were injected intraperitonialy (0.1ml) on each dose salt (0.25 mg and 0.50 mg / mouse). While the control group receivly the same dose of distilled water. After the last dose (14) day , animals were scarified and blood was collected by cardiac puncture and serum was separated. The samples of blood was stored in special tube until assayed.

Hematological and biochemical analysis :- Whole blood was analyzed for RBC and WBC count by using the hemocytometer methods , hemoglobin (Hb) by using sahli appertuse , and packed cell volume (PCV) was estimated by microhematocrite centrifuge spinning for (5min at 12000 rpm) . Sugar , urea , GOT , GPT, Alkaline phosphatase , and serum ceratinine was measured by making centrifuge of the samples for (15 min at 3500 rpm) using a kit from (Biocon Germany) and read results by different waves of spectrophotometers [13].

Statistical analysis :-

data was analyzed by using SPSS version 10 . the results were expressed as mean ± S.D , the significance of the mean difference between control group and two treatment groups was determined by revised least significant different (RLSD) and the level of ($P<0.01$) was used as the criterion of the statistically significant.

Results and Discussion

This study showed the effect of the potassium permanganate on blood parameters (Table 1) and the results showed that the RBC , WBC , PCV , and Hb had significant decrease($P<0.01$) in the treatment groups compared with the control group.

The defect in this result of the treatment groups may be due to the presence of manganese in this salt (metabolism of this defect due to the manganese toxicity)[14]. Ingestion high concentration of ($KMnO_4$) may cause abdominal pain , anemia and kidney damage [12]. Also it can result in poisoning with symptoms of capillary damage , hemolytic jaundice and tissue damage in the gastric mucosa of the intestinal [15,16].

The significant decrease in blood parameters attributed to manganese that may form met hemoglobin which in sufficient concentration leads to cyanosis (dusky color skin) due to the deficient O2 of the blood by convert ferrous (2+) iron into ferric state (3+) , this oxidizing form will precipitate as ferric hydroxide and manganese hydroxide [17]. Other causes of the decrease blood parameters when injection ($KMnO_4$) , permanganate reacts as manganese dioxide , and its absorbed in the small intestine competitive with iron. This leads to iron deficiency that causes anemia [18]. An iron responsive anemia can occur which induced with manganese toxicity due to an interference with intestinal iron absorption by excess manganese (this absorption is consistent with the anemia seen in humans and it indicate that large amount of manganese can interfere with intestinal iron absorption) [19].

The results showed that GOT,GPT and alkaline phosphatase change by decrease the levels of its in treatment groups (Table2). While no significant decrease in RBS, Blood Urea and serum cratinine when compared this results with control group($P<0.01$). (Table3).

The toxicological properties of this salt may cause eye, skin, respiratory and digestive tract irritation [20]. Also injection of ($KMnO_4$) solution in the experimental animals causes defect in CNS , liver and very harmful to the blood [21].

Renal and hepatic impairment have been reported and hematological involvement was also absorbed in severe causes (met hemoglobinemia hemolysis) , high dose duo to massive gastrointestinal hemorrhage [22]. This effect of the renal and kidney damage may lead to the defect of secretion of the erythropoietin and defect to the synthesis of red blood cells by the effects on bone marrow[23]. Higher manganese concentration in blood shown to accumulate in liver and may affect the function of it (inhibition of liver enzymes) [24,25].

The mechanism of manganese toxicity has been proposed by the decrease tissue level of protective thiol , glutathione , and catalase compounds , also manganese enhances glutamate receptor – mediated excitotoxicity [26,27]. Metabolism of manganese is similar to that of iron , it is absorbed in small intestine and while the absorption process is slow excess manganese is excreted in bile and pancreatic secretion , and only small amount is excreted in urine [28]. Excess manganese interferes with the absorption of dietary iron , long term exposure to excess levels may result in iron deficiency anemia and significant rise in manganese concentration have been found in patients with sever hepatitis and post hepatic cirrhosis [29]. Symptoms that will appear when the liver is diseased or affected in function (jaundice, nausea and vomiting , abdominal swelling and pain) this symptoms connected with the poisoning of the potassium permanganate and poisoning the manganese that means this salt attached to liver and it leads to inhibition of the activity enzymes of it and this explains the defect level of GOT,GPT, and alkaline phosphatase [30,31].

Table (1) :- The effect of potassium permanganate on blood parameters of female mice.

(N=8)

Treatment	RBC $\times 10^6$ mm	WBC (no. / mm^3)	PCV %	Hb gm%
Control distill water	9.200.000 ±0.25	4400 ±0.13	38.21 ±0.21	12.47 ±0.11
0.25 mg / mouse	7.800.000 * ±0.42	2600 * ±0.49	27.46 * ±1.33	9.81 * ±0.38
0.50 mg / mouse	6.600.000 * ±0.29	2150 * ±1.87	25.60 * ±0.31	9.29 * ±0.22

- significant decrease in ($P<0.01$).

Table (2) :- The effect of potassium permanganate on GOT , GPT , and alkaline phosphatase in female mice.

(N=8)

Treatment	GOT IU/L	GPT IU/L	Alkaline phosphatase Mg/dl
Control distill water	45.77 ±0.53	17.50 ±1.51	83.21 ±1.48
0.25 mg / mouse	67.59 ** ±0.19	14.22 * ±0.16	64.87 * ±1.78
0.50 mg / mouse	71.33 ** ±0.37	12.61 * ±0.64	62.86 * ±1.99

** significant increase in ($P<0.01$) .

Table (3) :- The effect of potassium permanganate on Random Blood Sugar , Blood Urea , and serum Creatinin in female mice.

(N=8)

Treatment	RBS Mg/dl	Bl. Urea Mg/dl	Serum Creatinin Mg/dl
Control distill water	197.55 ±0.28	39.21 ±1.75	86.66 ±0.39
0.25 mg / mouse	191.73 ±0.67	38.44 ±1.98	82.94 ±0.88
0.50 mg / mouse	192.50 ±0.32	36.32 ±1.69	81.81 ±0.74

No significant decrease in this table in ($P<0.01$).

Conclusion

The effect of potassium permanganate showed significant decrease in the blood parameters ,GPT and alkaline phosphatase , while significant increase appeared only in GOT when compared with control group . This defect may be due to the presence of manganese in this salt and potassium permanganate is considered a strong oxidizing agent that affects directory in the function of organs in the body

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بعض التاثيرات الفسيولوجية والكيموحيوية لبرمنغنات البوتاسيوم($KMnO_4$) في إناث الفئران المختبرية (*Mus Musculus L.)*

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الخلاصة

تعد برمنغنات البوتاسيوم من الاملاح المؤكسدة القوية والتي تستخدم لاذابة المركبات العضوية في الماء. ولدراسة تأثيرها على بعض المعايير الفسيولوجية تم اخذ 24 فأرا مختبريا قسمت الى ثلاث مجاميع واحدة عوملت كمجموعة سيطرة ومجموعتان حقنتا بالملح بواقع حقنة واحدة يوميا بالخلب ولمدة اسبوعين (0.25 ملغم/فأر, 0.50 ملغم/فأر) على التوالي.

معايير الدم اشتملت على (كريات الدم الحمر, وكريات الدم البيض, ونسبة الهيموكلوبين, وحجم الدم المظغوط) اظهرت انخفاضا معنويا واضحا عند المقارنة مع حيوانات السيطرة.

Alkaline ph.,GPT وانخفاضا معنويا واضحا في انزيم GOT من جانب اخر بينت الدراسة ارتفاعا معنويا في أنزيم بينما لم تظهر الدراسة أي فرق معنوي في نسبة السكر , ومعدل اليوريا في الجسم و نسبة الكرياتنين عند مقارنة هذه النتائج مع مجموعة السيطرة وتحت مستوى احتمال ($p<0.01$) .