Research Article

BASJVETRES

BASRAH JOURNAL OF VETERINARY RESEARCH, 2025, 24(1):66- 72.
https://bjvr.uobasrah.edu.iq/

Histological Study of Potassium Dichromate Effects on Ovaries and Thyroid Gland in Adult Female Rats

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DOI: https://doi.org/10.23975/bjvr.2025.154915.1153

Received: 11 November 2024 Accepted: 28 December 2024

Abstract

The current study was designed to know the effects of the Potassium dichromate (chromium) on the histological structure of ovaries and thyroid glands in adult female rats. Twenty-one adult female rats were divided into three groups. The first group (n=7) animals received distal water as the control group, the second group (n=7) animals received potassium dichromate dissolved in distal water at a dose (n= 8.5 mg\kg), and the third group (n=7) animals received potassium dichromate at a dose (n= 4.25 mg\kg) dissolved in distal water. Animals received chromium orally by gavage for 30 days. The animals were sacrificed at the last experiment, and the ovaries and thyroid were isolated for histological study. According to the results, the control group had normal ovarian histological structure, and the collagen fibers around the vascular tissues were also normal. The potassium dichromate-treated group showed cysts, hemorrhage, distortion of granulose cells, and collagen fibers not appearing with high doses. In the group that was given a low dose of chromium, histological sections of the ovaries showed a normal structure with few fibroblasts. Normal thyroid follicles appeared in the control group. Thyroid gland structure in the treatment group at high doses of chromium showed the epithelium follicles have hyperplasia with distortion of follicle cells and walls. The follicles in the low-dose chromium group showed damage to follicle cells, vacuolated, and limited hyperplasia. Therefore, chromium directly or indirectly affects the ovaries and thyroid glands.

Keywords. Potassium Dichromate, Female Laboratory Rats, Ovary

Introduction

Chromium is widely distributed and used in many industries (1). Naturally, chromium is found in food and water (2). Chromium has beneficial effects on public health, especially if used in small amounts in dietary intake; it increases metabolism rates (3, 4). Increased exposure to chromium leads to decreased body weight and regulates insulin hormone (5). As mentioned in a recent study, chromium is an important cause of enhancing obesity by decreasing fats and body weight (6) and effects on reproductive organs (1).

Studies have shown that chromium decreases cysts that occur with polycystic ovary syndrome (PCOS), and many compounds play a role in improving PCOS (7). Chromium is one of the essential elements in the balance of insulin and glucose in the body. At the same time, one study has shown that the use of chromium supplements has beneficial effects in reducing body mass, high fasting insulin, and some sex hormones, thus reducing the cysts associated with PCOS (8). There is a relationship between PCOS and insulin resistance (9). However, chromium-enhanced cysts reduce the insulin hormone in women with PCOS (10). A previous study showed chromium led to distortions of ovarian follicles (11)). Few studies mentioned chromium effects of thyroid gland and recorded that damaged of chromium effects of thyroid gland and recorded that damaged of affects the thyroid gland and damaged the thyroid histological structure (12). Hormones released from the thyroid gland decrease when animals are treated with chromium (13).

Materials and Methods

The present study was carried out on 21 adult female rats divided into three groups, each 7 rats. Group one is a control group that received (1 ml) distilled water orally. The second was that the treated group received Potassium dichromate orally (8.5 mg\kg) for (1) month. The third group, also treated group, received potassium dichromate orally (4.25 mg\kg) for (1) month. Potassium dichromate was supplied by the Russian chemical company\ Russia. At the end of the experiment, the rats were anesthetized with (ketamine and Xylazine). The ovaries and thyroid gland were isolated and put in formaldehyde (10%) for histological study.

Results

1-Histological examination of ovaries

Examination of ovary sections in the control group showed normal ovarian histological structure and normal collagen fibers surrounding the vascular tissues Figure (1). Compared to the control group, the group that was given 8.5 mg/kg of potassium dichromate had cysts, bleeding, granulosa cells that were twisted, and collagen fibers that were not there (Figures 2-3). In contrast to the control and treated groups at a high dose, the histological ovarian sections in the potassium dichromate-treated group at a dose of 4.25 mg/kg revealed normal ovarian structure with primary follicles, some inflammatory cells, and no cysts (Figure 4).

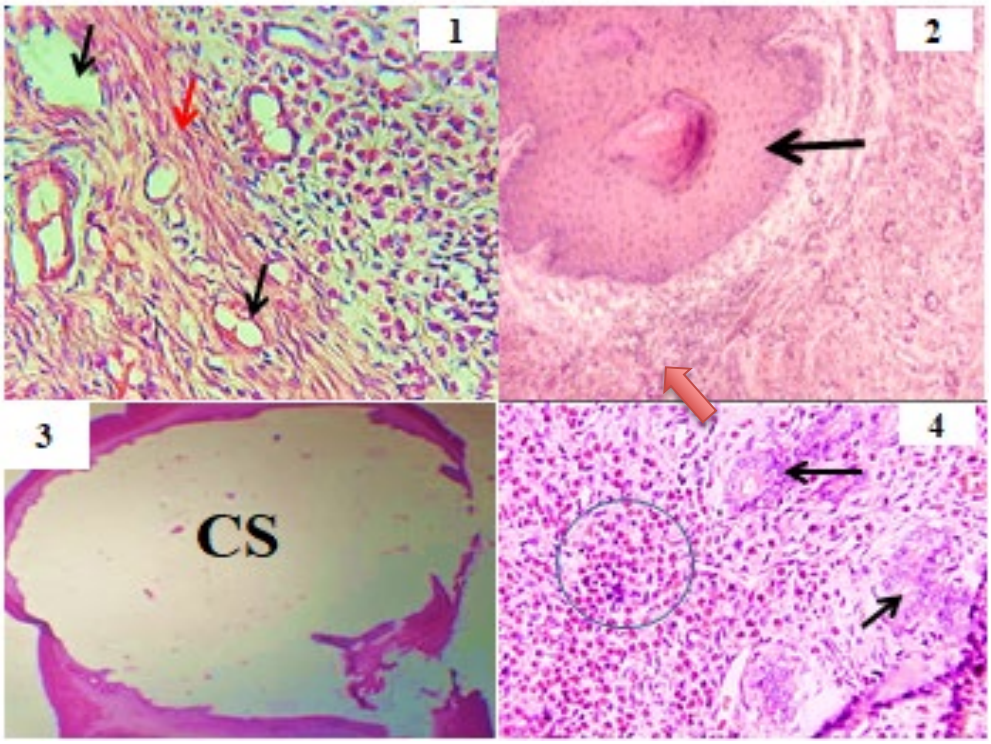

Figure (A): Sections of ovaries showed: (1) normal ovarian structure appeared collagen fibers (red arrow) surround capillaries (black arrows), (2) treated group with high dose of chromium showed hemorrhage (black arrow),tumor(rad arrow) (3) section of ovary with high dose of chromium showed cyst, (4) section of ovaries in chromium treated group with low does showed Inflammation cells (circle) primary follicles (black arrow) under light microscope with (H&E) (10x).

2-Histological examination of the thyroid gland

Normal thyroid follicles appeared in the control group. In the group that was given the high dose of chromium, the epithelium of the follicles had hyperplasia, and the cells and wall of the follicles were distorted (Figure 2). The follicles in the low-dose group of chromium exhibited damage to their cells, as well as vacuolated and progressive hyperplasia (Figure 3).

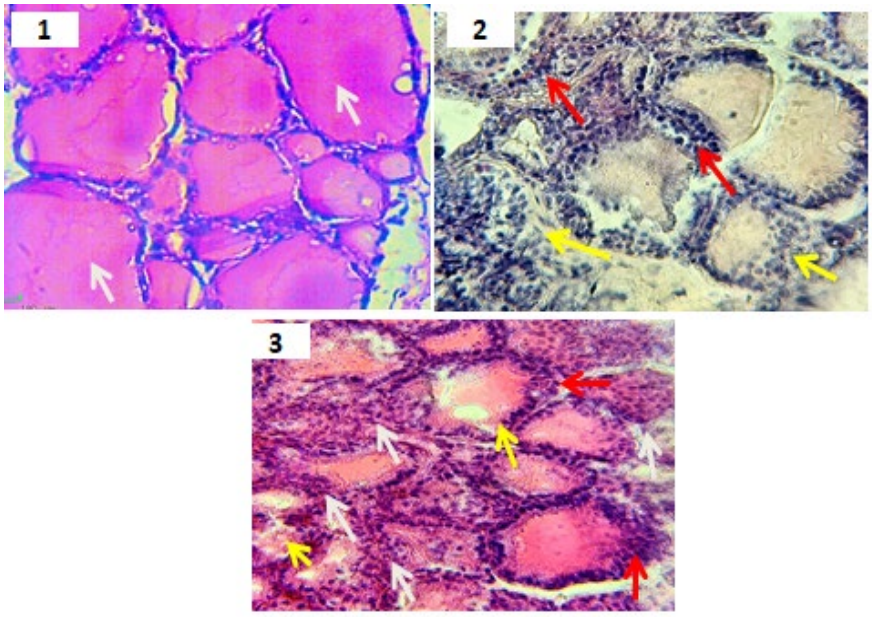

Figure (B): Sections of thyroid showed: (1) normal structure appeared and normal follicles (white arrows) in control group (2) thyroid structure in chromium treated group at high dose showed hyperplasia (red arrows) and distortion of follicles wall (yellow arrows), (3) section of thyroid with low dose of chromium showed damage of follicle cells (white arrows), hyperplasia (red arrow) and vacuolated under light microscope with (H&E) (10x).

Discussion

When sections of the ovaries from the control group were looked at, they showed normal ovarian histological structure and normal collagen fibers surrounding the vascular tissues. Compared to the control group, the group that was given high doses of potassium dichromate in the ovaries had cysts, bleeding, granulosa cells that were twisted, and collagen fibers that weren't there. Researchers studying potassium dichromate are finding significant changes in this element. This is because chromium is an environmental factor affecting reproduction and fertility. The degree of chromium poisoning and its duration determine its slow effects. These results agreed with (14) and showed that potassium dichromate at high doses led to a decrease in follicle cells. The collagen fibers were decreased in ovaries at high doses. The collagen fibers have protective and supporting effects of organs. According to (9, 15, 16), collagen fibers increase of ovaries, giving protection and supporting tissues. The cyst also appears on ovaries but is not considered PCOS according to (9), who showed cysts with PCOS must be increased by more than five in number. The group that received a low dose of chromium treatment had more granulosa cells, fibroblast cells, and some inflammatory cells in their ovaries. Compared to the control group, this group showed no cysts, despite receiving a high

dose of chromium treatment. Due to the high dose of potassium dichromate, the organs have changed. This is because the compound degrades tissue in the reproductive organs and makes it harder for them to make sex hormones. This result agreed with (17,18, 19). They showed chromium toxicity effects on reproductive tissues in high doses.

The histological effects of potassium dichromate on the thyroid gland showed normal thyroid follicles in the control group. The high dose of chromium in thyroid tissue caused the epithelium of follicles to grow too big, causing the follicle cells and wall to become distorted. These results were in line with (13), which showed that chromium damaged follicle cells in thyroid tissues from animals that were given it. It was thought that vacuolated and progressive hyperplasia of follicle cells in the thyroid follicles was normal at low doses of chromium but not at high doses. This result was in line with other studies (13, 20).

Conclusions

The current study concluded that chromium has histological effects on the ovaries and thyroid glands at lower and higher doses.

Conflicts of interest

The authors declare that there is no conflict of interest.

Ethical Clearance

This work is approved by The Research Ethical Committee.

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التأثير النسيجي لثنائي كرومات البوتاسيوم على المبايض والغدة الدرقية في أناث الجرذان البالغة

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الخلاصة

صممت الدراسة الحالية لمعرفة تأثير ثنائي كرومات البوتاسيوم على التركيب النسيجي للمبايض والغدة الدرقية في اناث الجرذان البالغة. واحد وعشرون من اناث الجرذان البالغة قسمت الى ثلاث مجاميع. المجموعة الاولى (ن =7) حيوان جرعت ماء مقطر كمجموعة سيطرة والمجموعة الثانية (ن=7) جرعت الحيوانات ثنائي كرومات البوتاسيوم (ملغم\كغم 8.5) الذائب في الماء والمجموعة الثالثة (ن =7) جرعت ثنائي كرومات البوتاسيوم بجرعة (4.25 ملغم\كغم) الذائب في الماء المقطر. جرعت الحيوانات ثنائي كرومات البوتاسيوم فمويا بواسطة المجرعة لمدة (30) يوم. تم التضحية بالحيوانات في نهاية التجربة وعزلت المبايض والغدة الدرقية للدراسة النسيجية. بينت النتائج ان المبايض طبيعية في مجموعة السيطرة والياف كولاجينية تحيط نسيج الاوعية. اوضحت مجموعة ثنائي كرومات البوتاسيوم المعالجة اكياس ونزف وتحطم في الخلايا الحبيبية وعدم وجود الياف كولاجين في الجرعة العالية. المقاطع النسيجية للمبايض المعالجة بالجرعة المخفضة من الكروميوم بينت التركيب النسيجي الطبيعي للمبايض مع قليل من الخلايا اللمفية المولدة. التركيب النسيجي للغدة الدرقية في المجموعة المعالجة بالجرعة العالية من الكروميوم بينت فرط تنسج في طلائية الحويصلات مع تحطم في خلايا الحويصلات وجدرانها. الحويصلات بالجرعة المخفضة من الكروميوم ظهرت متحطمة الخلايا وفجوات مع قليل من فرط التنسج. لذلك الكروميوم يؤثر بصورة مباشرة او غير مباشرة على المبايض والغدة الدرقية.

الكلمات المفتاحية: ثنائي كرومات البوتاسيوم، أناث الجرذان المختبرية، المبيض .