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Investigation of Potassium Dichromate Nephrotoxicity in Association with Vitamin C in Rate

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Abstract

Objective : Heavy metal poisoning in the environment has attracted a lot of interest in previous years. Hexavalent chromium is because it is widely used in various industrial uses, the goal of this study is to see how potassium dichromate affects renal tubules and to assessment of Vitamin C's Function as protective agent the effects of heavy metal (Potassium dichromate).

Materials and Methods : Male rates of the study were divided into three groups. Each group consists of 10 male rats used for the design experiments as the following (G1 control group , G2 received a dose of 1ml intraperitoneally of 2 mg/kg of body weight per day of potassium dichromate and G3 received both of the vitamin C in a dosage of 1ml in a concentration of 2mg/kg and potassium dichromate in a dose of 1ml in a concentration of 2mg/kg per day for 14 days and then they going to sacrificing and Histopathological examination

Results : Control group had normal glomerular and tubular histology in both the cortical and medullary areas of their kidneys**, G2** Potassium dichromate-treated rats showed necrosis of most convoluted tubules in the cortex; **G3** pre-treted Potassium dichromate-treated rats showed little histological changes of most convoluted tubules in the cortex

Conclusions : The result indicated the role of chromium compounds' toxicity in the induction of harmful effects in renal tissue and the protective role of ascorbic acid in decreasing these tissue changes.

Keywords : Potassium Dichromate, nephrotoxicity, hexavalent chromium, Vitamin C , rate

Introduction

In several Industries, Potassium dichromate regarded as wide ranged applications of soluble hexavalent chromium compound (1, 2) . The toxicity of chromium (Cr) compounds is extremely dangerous and often fatal. (3,4). Because of the numerous dyes of its compounds, It was given the name after the Greeks. "chroma," which meant colour. Chromium, as well as its salts, is mostly used in the manufacturing industry (5). In many surgical procedures like orthopedic surgery, chromium and cobalt alloys are also used as prosthetic agents (6). Chromium is also present in the smoke of cigarettes (7). On the other hand, Chromium is used in traditional treatments in various nations since it is a necessary component for humans in its trivalent form. (8). Hexavalent chromium consumption with diets such as meat or vegetables and water prevents trivalent chromium from entering the circulation (9, 10) . Chromium enters the body through the respiratory system, digestive system, and to a lesser extent, through the integumentary system, but for the general population (11). The principal route of

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chromium exposure is through oral consumption, which includes food and drink. (12). Trivalent chromium is poorly absorbed regardless of the method of exposure, Hexavalent chromium, on the other hand, is more easily absorbed. (13). Hexavalent chromium rapidly enters the cell via SO4 and HPO4 channels. (14) and will stay here for the rest of the cell's existence (15). Hexavalent chromium enters the cell and initiates a cascade of events that includes cellular reductases such as ascorbic acid and riboflavin, glutathione, and serum protein, all of which produce chromium intermediates. such as Cr (IV) and Cr (V) (16). Reactive oxygen species (ROS) will be produced when this reduction process (17). so the hematopoitic tissue turn to defective due to highly exposure to oxidative stress (18). The kidneys (urine) and the bile (feces) are the main rout of chromium elimination. (10) Hexavalent chromium compounds have been linked to kidney damage in people and experimental animals, according to previous research (19).

MATERIALS AND METHODS:

A total of 30 male adult albino rats (RattusRattus) weighing (150-200) grams were used in the study and ranging in age from 10 to 12 weeks .They were left for 4 weeks for an adaptation prior to the experiment. Each 10 animals were housed in an individual plastic cage measured as 15x35x50cm and they were received *ad libitum* with diet of standard pellet of diet supplied from IPA (Institute for Pubic Accuracy) ,counter for agriculture research. They had free access for water to drink and they were kept under the same condition of temperature (22-25) C and 14 hours of light and 10 hours of darkness was the light regime. Animals of the study were divided into three groups. Each group consists of 10 male rats used for the design experiments as the following (G1 control group , G2 received a dose of 1ml intraperitoneally of 2 mg/kg of body weight per day of potassium dichromate and G3 received both of the vitamin C in a dosage of 1ml in a concentration of 2mg/kg and potassium dichromate in a dose of 1ml in a concentration of 2mg/kg per dayfor 14 days . All experimental and animal handling protocols followed animal care guidelines and were ethically authorized by Al Ameed University's Ethics Committee for Human and Animal Care.

Animal sacrifice and sample collection:

All of study, rats were scarified on the 16th day of the experiment , at the completion of the treatment period before being sacrificed, the control and treatment animals were sedated by putting them in a closed jar containing cotton suck and diethyleyther anesthesia.. The abdominal cavities were widely opened to give a clear view for liver, kidney and spleen and the other samples that needed in the studies

Histological study:

The different organs (stored fragments) of the liver ,kidney were collected from all studied groups to prepared slides for a histological studies according (20) with aid of the light microscope .

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Result :

Control group had normal glomerular and tubular histology in both the cortical and medullary areas of their kidneys. depicts the healthy anatomy of kidneys in slices of normal kidneys, that contain a large number of tubules with glomeruli**, G2** Potassium dichromate-treated rats showed necrosis of most convoluted tubules in the cortex, as well as loss of nuclei in the necrotic tubules' lining epithelium with abundant amount of WBC infiltration In addition to the scattered inflammatory material presented in the field; **G3** Potassium dichromate and ascorbic acid -treated rats showed congestion of most convoluted tubules in the cortex, loss of nuclei in the necrotic tubules' lining epithelium with less severity in comparison with G2, The present result, observes treated with vitamin C at dose of 120mg/kg can lead to more pronounced increase activity of reduced oxidative stress and protect against cytotoxic effects of Cr (VI) .

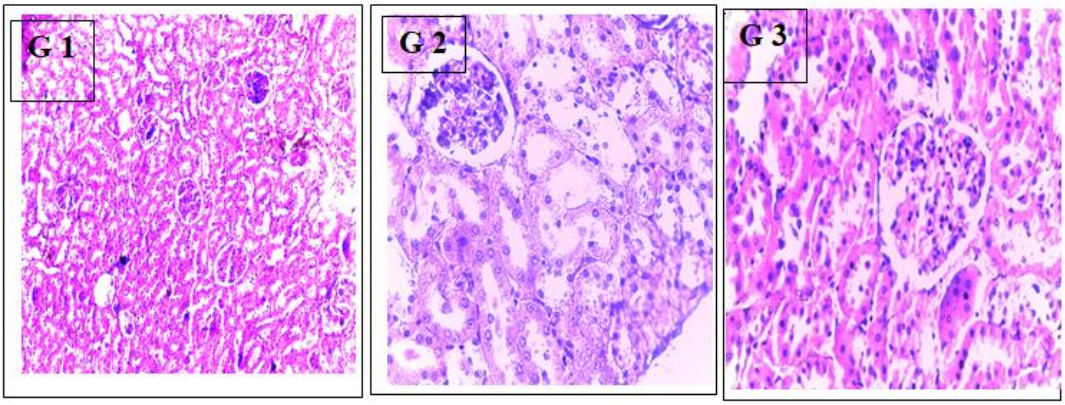

Figure 1. **G1** 4X magnification of control group showed normal architecture of renal tubules, **G2** 10X showed diffuse neutrophil filtration with necrotic lesions in some convoluted tubules , **G3** 10X showed mild congestion with some signs of acute inflammation

Discussion

The objective of this study was focused the light on the benefits of vitamin C on potassium dichromate, which caused oxidative damage in the kidneys of male rats, were the subject of this investigation. The outcomes of this investigation were comparable to prior observations made by workers. (21,22) These authors documented chromium exposure that resulted in male organ damage as well as reversible oxidative stress in seminal plasma and spermatozoa (23). The histology findings of this investigation were comparable to contemporary monkey studies (24). The findings of this study revealed that a fifteen-day exposure to potassium dichromate [hexavalent chromium (VI)] caused nephrotoxicity in adult male rats (25) . The kidney is the primary route of Cr excretion; acute potassium dichromate treatment in rats increased the kidney's Chromium concentration. (26). Chromium (vi) has been also reported to induce numerous effects of different acute and chronic toxicities, such as; neurotoxicity, dermatotoxicity, carcinogenicity, immunogenicity and general environmental toxicities in human and laboratory animals (24). Concomitantly, with these complex reversible and or irreversible deterioration of cellular and tissue impairment of chromium dose dependent.

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There was proof with excessive production of many free radical types resulting in oxidative stress, which associate with continuous depletion of the enzymatic bodily antioxidants such as, catalase, superoxide dismutase and glutathione were detected defense cellular system (27, 28). It is believed that vitamin C (ascorbic acid) is an important biological reduction in humans and animal tissues. As well as, to its more potent reductant for Cr (VI) than gluthine under physiological condition (28).

Conclusions

Conclude that ascorbic acid offered complete protection via deletion of free radical and oxidative stress to exist preservative and maintenance intact physiological male reproductive properties . The protective role of vitamin C, that slightly and moderate improved the histological structure in the seminiferous tubules, prostate. Also the role of vitamin C decreased the harmful effect of potassium dichromate on the tissue.

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