

An Experimental Study to Identify the Effects of Hexavalent Chromium on Skin of Albino Rats (*Rattus Norvegicus*)

ANEEQA CHUGHTAI¹, MUHAMMAD UMAR², SHAHZAD AHMAD³, SHAZIA IQBAL⁴

ABSTRACT

The current study described the harmful effects of hexavalent chromium in the skin. In this study albino rats were used as experimental animals. The oral (4mg/kg b.w) administration of hexavalent chromium was given to the albino rats. A significant (< 0.05) increase of hexavalent chromium was seen in both skin homogenate (2.018±.236 µg/g of wet tissue) and blood serum levels (2.331±.658 10µg/ml) of group B than Group A (0.0024±.00059 µg/g of wet tissue) and (0.097±.0015 10µg/ml) respectively. This study described that hexavalent chromium may cause cytotoxicity and genotoxicity in a biological system.

Keywords: Hexavalent chromium, Albino rats,

INTRODUCTION

The major and big organ of the body is skin. The skin protects all the body from microbes, elements and it helps to regulate body temperature. The skin is more sensitive and provides the sensations of touch, heat, and cold. Skin has three layers first layer called epidermis it is the outer most layer and made skin waterproof barrier (Baroli, and Biancamaria., 2010). The second layer called dermis which has sweat glands hair follicles, and many types' connective tissues. The third and deepest layer is made up by subcutaneous tissues.

Hexavalent chromium is a chemical compound that contains the element chromium in the +6 oxidation state (Acrani et al., 2010). Hexavalent chromium is mostly uses in many industries in Pakistan especially it used in wood preservation, textile dyes anti-corrosion products, paint industry and chrome plating (Doisy et al., 1976). It is also used in chromic acid electro-plaiting. Different scientists described in their studies that Hexavalent chromium compounds are carcinogens in nature it may cause cellular toxicity and genotoxicity (Shin et al., 2000).

It has proved by number of studies that hexavalent chromium enters into the cell through sulfate channels of plasma membrane and ultimately after crossing the nuclear membrane it creates mutation in the DNA strand during mRNA formation (Aggarwal et al., 2006). Hexavalent chromium in

certain conditions reduced into Cr(V), Cr(IV) and ultimately Cr(III) by the action of ascorbic acid, glutathione (GSH) reductase and hydrogen peroxide (H₂O₂) (Salnikow et al.,2008). Hexavalent chromium mostly does lipid peroxidation (Agostini et al., 2002). A study stated that dermal exposure of hexavalent chromium produced irritant and allergic contact dermatitis (Chuang et al., 2001). Primary irritant dermatitis is a cytotoxic property of chromium whereas allergic contact dermatitis is an inflammatory condition.

MATERIALS AND METHODS

In this study albino rates were used as experimental animals. Rats were divided into two groups i.e. Group A and Group B. 10 rat were in each group. Group A was control while the oral administration of hexavalent chromium (4mg/kg b.w) was given to the rats of Group B. The project was remained at one month in IMBB department, The university of Lahore. At the end of experiment the animals were sacrificed. Blood samples were collected in glass tubes and Serum were separated by centrifugation for 10 minutes at 3000 rpm, Some skin lobes will be kept in 10 % formalin for histopathological examination. Histopathological changes in skin tissues stored in formalin were observed microscopically after hematoxylin and eosin staining. The weight of all rats of Groups A and B was in between 100-150 grams. Raw data was analyzed by using SPSS. P value of < 0.05 was considered as significant.

RESULTS

Control skin (Fig.8a, h & e, x 40). Control skin (Fig.A). Chromium treated skin (Fig.8b, H & E, x 200)

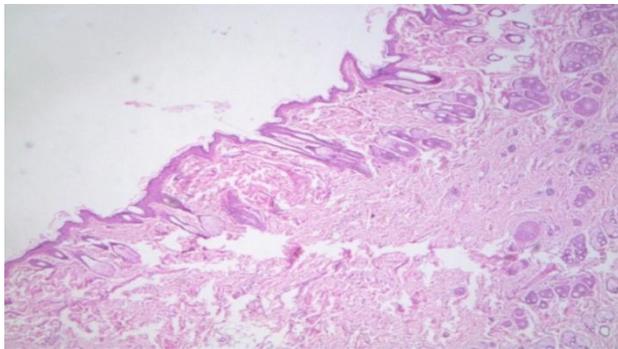
¹Asst professor Anatomy, CMH Lahore Medical College Lahore-

²Assistant professo Anatomy, Nawaz Sharif Medical College University of Gujrat

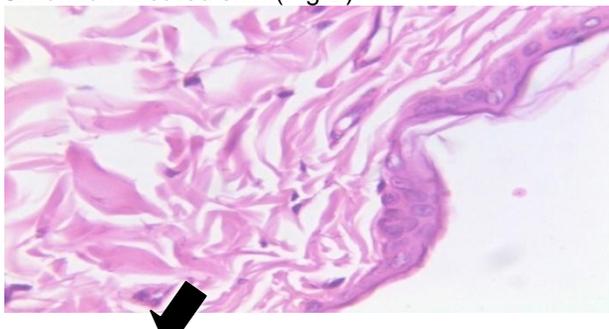
³Assistant professor Department of Oral Pathology , FMH College of Medicine and Dentistry, Lahore

⁴Assistant professor Department of Obstetrics and Gynecology Alfarabi College of Medicine, Riyadh KSA.

Correspondence to Dr. Aneeqa Chughtai Email: aneeqa65@gmail.com_cell no: 03314319507



Chromium treated skin (Fig.B).



Photomicrograph of hexavalent chromium treated skin is showing changes mainly in the dermis. There are thick collagen bundles (arrow) and few chronic inflammatory cells as well.

Group A... (n=10) Skin hexavalent chromium levels ($\mu\text{g/g}$ of wet tissue)

Group of rats	Group A	Group B
Skin hexavalent chromium levels ($\mu\text{g/g}$ of wet tissue)	0.0024 \pm .00059	2.018 \pm .236
Mean values \pm SD	0.0020 \pm .00036	1.2082 \pm .349

< 0.05

Group B... (n=10) Serum hexavalent chromium levels ($\mu\text{g/ml}$)

Group of rats	Group A	Group B
Serum hexavalent chromium levels ($\mu\text{g/ml}$)	0.097 \pm .0015	2.331 \pm .658
Mean values \pm SD	0.1076 \pm .0254	1.5134 \pm .752

< 0.05

The oral administration of hexavalent chromium was (4mg/kg b.w) to albino rats and a significant < 0.05, increase (2.018 \pm .236 $\mu\text{g/g}$ of wet tissue) of hexavalent chromium was seen in the skin of rats than the control (0.0024 \pm .00059 $\mu\text{g/g}$ of wet tissue). Similarly the hexavalent chromium blood serum levels also showed (significant < 0.05) increase in the individuals of Group B (2.331 \pm .658 $\mu\text{g/ml}$) than the Group A (0.097 \pm .0015 $\mu\text{g/ml}$).

DISCUSSION

The current study described the contamination of hexavalent chromium in the environment. Hexavalent chromium is very frequently used in many industries of Pakistan, where workers are highly on risk because it has proved by different studies that hexavalent chromium is carcinogenic in nature. A scientist (Stern., 2010) described in his study that hexavalent chromium is carcinogenic and cause cancer. In this study when oral administration of hexavalent chromium (4mg/kg b.w) in water was given to the albino rats of Group B. The cytotoxic and genotoxic effects were noted in biological system of Group B rats. A significant (< 0.05) increase of hexavalent chromium in the skin and blood serum levels of Group B rats were observed than the control respectively. Meduri et al., 2007 stated in their study the same findings as the current study.

REFERENCE

1. Agostini D, F Izzotti, A Bennicelli, C Camoirano, A Tampa and D.S Flora (2002). Induction of apoptosis in the lung but not in the liver of rats receiving intra-tracheal instillations of chromium(VI). *Carcinogenesis*;23: 587–593.
2. Aggarwal BB, H Ichikawa, P Garodia, P Weerasinghe, G Sethi, D Bhatt, MK Pandey, S Shishodia and MG Nair (2006). From traditional Ayurvedic medicine to modern medicine identification of therapeutic targets for suppression of inflammation and cancer; 10(1): 87-118.
3. Agostini D, F Izzotti, A Bennicelli, C Camoirano, A Tampa and D.S Flora (2002). Induction of apoptosis in the lung but not in the liver of rats receiving intra-tracheal instillations of chromium(VI). *Carcinogenesis*;23: 587–593.
4. Baroli, Biancamaria (2010). "Penetration of nanoparticles and nanomaterials in the skin: Fiction or reality?". *Journal of Pharmaceutical Sciences*. **99** (1): 21–50.
5. Chuang SM and JL Yang (2001). Comparison of roles of three mitogen- activated protein kinases induced by chromium (VI) and cadmium in non-small-cell lung carcinoma cells. *Mol Cell Biochem*; 222:85–95
6. Doisy R.J, DHP Streeten, JM Freiberg and AJ Schneider (1976). Chromium metabolism in man and biochemical effects. *Trace Elements in Human Health and Disease. Essential and Toxic Elements*. Vol. 2. Academic Press, NewYork.79–104.
7. Meduri, NB; Vandergriff, T; Rasmussen, H; Jacobs, H (2007). "Phototherapy in the management of atopic dermatitis: a systematic review". *Photodermatology, photoimmunology & photomedicine*. **23** (4): 106–12
8. Salnikow, K.; Zhitkovich, A. (2008). "Genetic and Epigenetic Mechanisms in Metal Carcinogenesis and Cocarcinogenesis: Nickel, Arsenic, and Chromium". *Chem. Res. Toxicol.* **21** (1): 28–44.
9. Shin, Yong Chul; Paik, Nam Won (2000). "Reduction of Hexavalent Chromium Collected on PVC Filters". *AIHAJ - American Industrial Hygiene Association*. **61** (4): 563–567.
10. Stern, A. H. (2010). A quantitative assessment of the carcinogenicity of hexavalent chromium by the oral route and its relevance to human exposure. *Environmental Research*, 110(8), 798-807.