

# Role of Green Tea on Cadmium Toxicity on Haematological Profile of Albino Rats

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## ABSTRACT

The aim of present work is to investigate the effects of green tea on some blood parameters of male albino rats with cadmium toxicity. 24 Male albino rats were divided into 4 groups, 6 normal rats and 18 cadmium intoxicated rats. Group 1 without treatment (controls), group 2 treated with cadmium, group 3 and group 4 treated with cadmium and green tea. Group (1) was fed on a standard diet as a control. Group (2) was fed on a standard diet and received a dose of 1mg/100g body weight. Group (3) was fed on a standard diet supplemented with 2g GTE and received a dose of 1mg cadmium chloride. Group (4) was fed on a standard diet supplemented with 4g GTE and received a dose of 1mg cadmium chloride. The experimental duration lasted for 30 days initiated from the first dose. The results showed cadmium decreased PCV ( $P < 0.001$ ), Hb% ( $P < 0.001$ ) and RBC ( $P < 0.005$ ) counts and elevated the TLC ( $P < 0.005$ ) and DLC count comparing with the control group of rats. However, the orally feeding of GTE with Cd treatment could significantly improve the changed levels of above parameters. These data suggested that, GTE possesses a protective effect on the above blood profile against the cadmium toxicity.

**Keywords:** cadmium, green tea extract (GTE), RBCs, Hb%, PCV, TLC.

## INTRODUCTION

Cadmium (Cd) is a toxic metal that is present throughout the environment and in humans and animals accumulates primarily in liver and kidneys<sup>3,13</sup>. Chronic Cd exposure can result in liver injury including nonspecific inflammation and apoptosis<sup>18,25</sup>. It is an established toxic and carcinogenic heavy metal pollutant<sup>3</sup>. It is used in various

chemical forms in the metallurgical and other industrial processes such as the production of pigments, batteries and reagents<sup>12</sup>. Environmental exposure to Cd can occur through the diet and drinking water<sup>25</sup> or by Cd fume inhalation<sup>18</sup>. The element accumulates predominantly in the liver and kidney<sup>16</sup>. Hepatotoxicity is

reported to be a major cause of acute Cd lethality<sup>11</sup>. The reaction mechanism is proposed to involve the generation of reactive oxygen species (ROS)<sup>19</sup>. Antioxidants such as vitamin C, E and Selenium have been demonstrated to counter free radical generation by Cd<sup>21</sup>.

*Camellia sinensis* (L.) O.Kuntze, belongs to family Theaceae (commonly known as green tea in English) has antioxidant, anticarcinogenic, antiviral, and bactericidal properties<sup>14</sup>. Green tea is a rich source of polyphenols, which are antioxidants in nature. Among the various types of tea, green tea contains a relatively high level of polyphenols, which consist of flavanol monomers (flavan-3-ols), also referred to as catechins<sup>4</sup>. Natural antioxidants, such as polyphenols from green tea extracts, have recently attracted considerable attention for preventing oxidative stress-related diseases including cancers, cardiovascular diseases and degenerative diseases<sup>22</sup>. Antioxidant properties, ROS scavenging, and cell function modulation of flavonoids could account for the large part of their pharmacological activity<sup>29</sup>. In the present study, an attempt has been made to find out the effects of *C. sinensis* on haematological profile against cadmium toxicity.

## MATERIALS AND METHODS

### Preparation of extract

Green tea is prepared by picking, lightly steaming and allowing the leaves to dry. Tea was procured from Tea State of Tata Group of Company, TALAT, Assam. Preparation of aqueous extract of *Camellia sinensis* was done according to the method described by (Dahiru *et al.*, 2007)<sup>5</sup>. A 2.0 or 4.0 mg/100g body weight (Singh *et al.*, 2013)<sup>33</sup> of extract was given orally to treat rats.

### Experimental animals

Male Wistar strain albino rats (7-8 weeks old) procured from Animal Division of IVRI, Izatnagar, were maintained in the animal facility of the Zoology Department of Meerut College, Meerut with standard food pellets and tap water *ad libitum*. All animals were cared for according to guidelines of the Institutional Animal Ethics by IAEC (384/PO/a/01/CPCSEA 28-03-2001). Committee (IAEC) and experiments were also approved.

### Experimental design

Animals were acclimatized for laboratory conditions and kept on normal diet for two weeks. After 2 weeks, each rat received a dose of 1 mg/100 g body weight cadmium chloride by oral route for 30 days. Experimental animals were divided into following 4 groups of 6 animals each:

Group I: normal rats.

Group II: cadmium control group.

Group III: animals were given a dose of 2.0 mg/100 g body weight aqueous extract of *C. sinensis* leaf orally.

Group IV: animals were given a dose of 4.0 mg/100 g body weight aqueous extract of *C. sinensis* leaf orally.

### Haematological studies

The rats were sacrificed under light ether anesthesia after 30 days. The blood samples were collected by cardio-puncture in fluoride tubes for analysis. Haematology was done according to standard methods<sup>4</sup>.

### Statistical analysis

Results were expressed as Mean  $\pm$  SD. The student's t-test was used for pair wise comparison of means. Statistical significance was accepted at  $p < 0.05$ .

## RESULTS & DISCUSSION

The effects of Cd administration and green tea on haematological profile are represented in table 1. The packed cell

volume (PCV), haemoglobin concentration Hb%, and RBC counts in the Cd treated rats were significantly reduced compared with the control group. In all the groups treated with antioxidants there was a significant increase ( $p < 0.05$ ) in their respective PCV, Hb% and RBC count compared with the Cd treated group. MCV, MCH and MCHC percentage are based on PCV, Hb% and RBC count. The level of these parameters showed changes according to these changes (Table 2). The TLC Count increased non-significantly as a result of Cd administration and came down to normal levels after both doses of *C. sinensis* as well as reversibility groups. DLC also showed changes according to the changes in TLC. DLC was also normal.

Yung-His-Kao<sup>32</sup> studied the effects of different catechines of *C. sinensis* although the experimental design is different from ours. They reported increase in PCV, Hb% and RBC count with ECG and ECGC. Grinberg<sup>1</sup> had also reported protection of red blood cells against oxidative damage by tea polyphenols.

Anemia is an important manifestation of cadmium toxicity<sup>3</sup>. Cd induced anemia has been attributed to an impairment in the synthesis of erythropoietin, a hormone whose function is to promote formation of the red blood cells<sup>15</sup>. Various haematological parameters were evaluated in this study (Table 1). The PCV, Hb% and RBC count in the Cd treated rats were observed to be significantly reduced ( $p < 0.001$ ) compared to control. Wilson<sup>28</sup> noted that rats develop anemia when exposed to dietary Cd levels as low as 31 ppm. Friberg<sup>10</sup> had observed anemia in humans as a consequence of environmental exposure to Cd. The liver, spleen and bone marrow are the major haematopoietic organs which serve as targets of Cd exposure<sup>23</sup>. The present study has, however demonstrated that Cd induced anemia can be reversed following drinking of green tea.

The TLC count is regarded a non-specific predictor of various pathologic conditions including stress<sup>17</sup>. There was an increase in the TLC count for the entire Cd treated group. With treatment both doses of *C. sinensis* this level came down to normal. When we go through DLC, no. of neutrophils is decreased and no. of lymphocytes is increased. Number of eosinophils, monocytes and basophils remained unaffected. Levels of neutrophils and lymphocytes came down to normal after 30 days treatment in 1 mg cadmium dose group. In reversibility study also almost same pattern for TLC and DLC was observed.

## CONCLUSION

Exposure to Cd has been demonstrated to alter the activities of haematological profile in male rats. This accounts for the toxicity of this element to haematopoietic tissues. The green tea which have antioxidant properties reversed the alterations in haematological parameters and thus ameliorate the toxic effects of Cadmium.

In conclusion, the results of this study indicate that treatment of rat with green tea extract had a marked protective effect against cadmium toxicity

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**Table 1.** Concentrations of serum parameters in blood obtained from three groups of rats

Analyzed parameters group	Control group	Cd group	Cd+ Green tea group	Cd+ Green tea
		1mg/100gm bwt	1mg+2mg/100g bwt	1mg+4mg/100g
Hb gm/dl	10.60±0.45	6.89±0.90 <sup>c</sup>	8.75±1.67	9.90± 0.77
RBCs million/cumm	4.72±0.25	3.08±0.78 <sup>b</sup>	3.42±0.48	4.23±0.42
PCV%	42.00±2.45	26.67±3.95 <sup>c</sup>	37.50±2.03 <sup>c</sup>	42.00±3.21 <sup>c</sup>
TLC cumm	8125±346	12733±3625 <sup>d</sup>	7417±1085 <sup>a</sup>	6983±1055 <sup>a</sup>

**Table 2.** Concentrations of serum parameters in blood obtained from three groups of rats

Analyzed parameters	Control group	Cd group	Cd+ Green tea group	Cd+ Green tea group
		1mg/100gm	1mg+2mg/100g bwt	1mg+4mg/100g bwt
DLC % N	42.67±4.18	32.33±2.73 <sup>c</sup>	35.17±1.47	41.83±3.83 <sup>c</sup>
L	53.50±5.92	66.83±6.08 <sup>c</sup>	60.33±2.66	55.00±7.56
E	2.33±0.52	1.83±0.75	1.67±0.82	1.83±0.75
M	2.17±0.75	0.17±0.41	2.50±1.38	2.50±1.38
B	0.67±0.52	0.17±0.41	0.33±0.52	0.50±0.55
MCV $\mu\text{m}^3$	105±19.98	87.61±19.67	112±17.22	97.17±6.02
MCH Pg	25.06±7.35	24.11±5.51	25.80±5.07	23.57±2.82
MCHC %	23.60±2.82	28.11±6.51	23.17±3.96	24.20±1.80

Values are mean  $\pm$  SD Rats for each reading = 6, Significance as per Student “t” test, a = P<0.01, b = P<0.005, c = P<0.00, N= neutrophil, L= lymphocytes, E= eosinophil, M=monocytes, B=basophils.