



## EFFECTS OF SUB-CHRONIC EXPOSURE OF THE FOOD DYE TARTRAZINE ON THE HAEMATOLOGY OF SWISS ALBINO MICE (*MUS MUSCULUS* L.)

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### ABSTRACT

Tartrazine is a colorant widely used in food products, drugs and cosmetics. The current study evaluates toxic effects of both low (100 mg /kg body weight) and high dose (200 mg/kg body weight) of tartrazine on general health and haematology of Swiss albino mice exposed for 72 days through drinking water. There were dose dependent increase in body weights (11.2-16.1%), RBC counts (10.8-24.3%), Hb (9.8 - 25.9%), P.C.V. (8.6 - 25%) and Total leukocyte counts (25 - 42.5%) of treated groups when compared with control. Their platelets counts however, decreased (11.1 - 22.2%).

**Key words:** Tartrazine, sub-chronic toxicity, haematology, Swiss albino mice

### INTRODUCTION

Tartrazine is an artificial yellow azo dye having trisodium salt of 3-carboxy-5-hydroxy-1 (p-sulfophenyl) -4- (sulfophenyl azo) pira-zolone. It is widely used as colorant in sweets, chewing gum, jellies, puddings, juices, jams, sodas, drugs and cosmetics. Because it is a nitrous derivative (azo class), it is reduced to an aromatic amine in the organism which is highly sensitizing. Its main metabolite identified to date is sulfanylic acid (Jones et al. 1964, Roxon et al. 1967, Maekawa et al. 1987, Chung et al. 1992).

Tartrazine has been implicated as the food additive affecting individuals in the long run with allergy, asthma, purpura and eczema etc. Some countries such as Sweden, Switzerland and Norway have withdrawn tartrazine use on the grounds of its anaphylactic potential but unfortunately it is widely used in the developing countries like India in the food stuffs. In the present study, we report sub-chronic toxicity of dye on general health and haematology of Swiss albino mice.

### MATERIALS AND METHODS

**Test Material:** Tartrazine C.A.S. No – 1934-21-0

**Test Animal:** 4 weeks old male Swiss albino mice *Mus musculus* L.

#### Experimental Design

Animals reared in the animal house under standardized conditions as per recommendations of Institutional Ethical Committee (1678/GO/a/12/CPCSEA) were divided in to 3 groups each with 5 animals and were kept individually in

the polypropylene cages. Two doses of dye were given orally mixed with the drinking water for 72 days as detailed below.

Group 1 (As Control Group): Standard feed + potable water

Group 2 (As Tartrazine treated Group)

(A) Standard Feed + Potable water mixed low dose of Tartrazine (100 mg/kg /b.wt.)

(B) Standard Feed + Potable water mixed high dose of Tartrazine (200 mg/kg /b.wt.)

After the 72 days of exposure, autopsy of animals were done by cervical dislocation. Cardiac blood was collected in the vials containing sodium salt of ethylene diamine tetra acetic acid (EDTA). Haematological parameters analyzed were; RBC and WBC counts, Hb, Packed Cell Volume (PCV), Mean Corpuscular Volume (MCV), Mean Corpuscular Hemoglobin (MCH), Mean Corpuscular Hemoglobin Concentration (MCHC) and Platelets counts (Lee et al. 1999).

The data expressed as Mean  $\pm$  SEM were also subjected to Student's t-test using SYSTAT computer program version 5.0 to find significant difference between values of various parameters recorded for control and treated animals.

### RESULTS

Dye exposure altered feed and water intake of the mice. Compared with control, feed intake of mice decreased (7.5%) after exposure to low dose of dye, but increased (12.9%) in mice exposed to its higher dose. The water intake was however, not affected (Table 1). Dye exposure however,

increased body weights of mice (Table 1). The percentage increase in body weights was higher at higher dose (16.1%) in comparison to mice exposed at lower dose (11.2%) and may be related to increase in water retention in the body due to malfunction of kidney.

### Effects on Haematology

Compared with control, RBC and WBC counts, Hb and PCV increased in dose dependent manner in the tartrazine treated mice, while values of MCV, MCH and MCHC were almost similar to control (Table 2). Platelets counts however, decreased (11-22%) in the tartrazine treated mice.

Table 1. Effects on feed and water intake, and body weights of Swiss albino mice after sub-chronic exposure at 2 doses of tartrazine (mg/kg/body weight)

Parameters	Control	Treatments	
		100mg	200mg
Feed intake (g)	7.8±1.71.96	7.2±3.3 (-7.5%)	8.2±6.9 (12.9%)
Water intake (mL)	7.9 ± 2.4	7.8±2.3 (-1.4%)	8.1±3.9 (2.8%)
Body weight (g)	32.2±1.5	35.8±0.8* (11.2%)	37.4±0.5* (16.1%)

Data in parenthesis represent % change in the values in comparison to control. Significant at 5%\*

Table 2. Effects of tartrazine on the haematology of Swiss albino mice

Parameters	Control	Low dose (100mg/kg/b.w.)	High dose (200mg/kg/b.w.)
R.B.C. ( $\times 10^6 \text{ mm}^3$ )	3.7±0.3	4.1±0.2*** (10.8%)	4.6±0.2*** (24.3%)
WBC ( $\text{mm}^{-3}$ )	4000 ±311	5000 ±391* (25%)	5700 ±444 (42.5%)
Hb (g%)	11.2±0.3	12.3±0.4*** (9.8%)	14.1±0.4*** (25.9%)
PCV (%)	33.6±1.2	36.5±0.6 (8.6%)	42.0±0.8*** (25%)
MCV(fl)	90.8±0.5	91.2±0.3 (0.4%)	91.3±0.2** (0.5%)
MCH(pg)	30.2±0.4	30.0±0.4 (-0.7%)	30.4±0.3 (0.7%)
MCHC (%)	33.0±0.2	32.5±0.4 (-1.5%)	33.3±0.5 (0.9%)
Platelets counts (lakh/mm)	1.80±.16	1.6±0.16 (-11.1%)	1.4±0.19 (-22.2%)

Data in parenthesis represent % decrease/increase in the values in comparison to control. Significant at 5%\*, 1%\*\*, and 0.1%\*\*\*.

## DISCUSSION

Tartrazine exposure increased feed intake of mice at higher dose but their body weights increased at both at lower and higher dose (Table 1). Our findings are in agreement with other workers reported increase in body weights of the experimental animals exposed to sunset yellow (Somia et al. 2016), tartrazine (Mehedi et al. 2013), 4 synthetic food and drug colourants (Osman et al. 1995), chocolate brown (Sharma et al. 2005a), orange red (Sharma et al. 2005b), malachite green (Chakravarty et al. 2005), apple green (Sharma et al. 2006), orange G (Chakravarty et al. 2006), tomato red (Sharma et al. 2006, 2008) and lead chromate (Chakravarty et al. 2007).

Tartrazine exposure increased values of RBC, WBC, Hb and PCV but decreased platelets counts in the Swiss albino mice (Table 2). Mehedi et al. (2013) reported increase in the values of RBC, Hb and Ht in tartrazine fed Swiss albino mice but reduction in WBC counts. Sharma et al. (2009) reported increase in MCV and MCH but reduction in Hb, TEC, TLC, PCV in the experimental animals exposed to both low and high dose of tartrazine. The increase in WBC counts was observed in the experimental animals exposed to malachite green (Chakravarty et al. 2005). Imafidon et al. (2015) reported a significant increase in haematocrit value (P.C.V.) in the rats exposed to tartrazine though their RBC counts and Hb content were almost similar to control. Somia et al. (2016) made findings similar to present study in the experimental animals exposed to sunset yellow. The increase in RBC and WBC counts, Hb and PCV may be in response to oxidative stress (Guyton and Hall 2006) while reduction in platelets counts may be attributed to toxic effects of food dye on the bone marrow of tartrazine fed experimental animals.

Present investigation revealed haematological disorders in Swiss albino mice exposed to tartrazine dye and this warrants awareness among consumers about its ill effects.

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