International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 10 Issue 4, Jul-Aug 2026 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Effects of Bisphenol A on Body Weight and Hematological Parameters of *Mus musculus*

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ABSTRACT

Bisphenol A (BPA, chemical name - 4,4'-dihydroxy-2,2-diphenyl propane and its chemical formula - $C_{15}H_{16}O_2$) is a synthetic chemical extensively used in the production of epoxy resins, polycarbonated plastics, feeding & water bottles, food containers, toys, dental devices etc. The widespread use of BPA in consumer products raises major concerns about its potential impact on human health. This study was conducted to examine the impacts of BPA on body weight and hematological parameters (RBC, WBC, Hb%) in male *Mus musculus*. For performing this research study healthy adult Swiss albino mice were taken in 4 groups (control, vehicle, low dose BPA & high dose BPA). Mice were given daily oral doses of BPA at 55 mg/kg (low dose) and 110 mg/kg (high dose) of body weight for 28 days. At the end of dosing, blood samples were collected and analyzed for the above study. The results suggest that BPA exposure led to notable alterations in body weight, likely due to its effects on metabolism and endocrine disruption. BPA exposure causes hematotoxicity, including alterations in RBC count, WBC count, and hemoglobin levels. These findings highlight the harmful impacts of BPA on mammalian health and point out the importance of further research to examine its prolonged risks.

KEYWORDS: *Bisphenol A (BPA), Mus musculus, Swiss albino mice, Body weight, hematology, toxicity, RBC count, WBC count, Hemoglobin.*

How to cite this paper: Padmaja Kumari | Prof. Ashok Kumar Thakur "Effects of Bisphenol A on Body Weight and Hematological Parameters of Mus musculus" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-10 | Issue-4, August 2026, pp.810-815, URL: www.ijtsrd.com/papers/ijtsrd142081.pdf

IJTSRD142081

1. INTRODUCTION

Exposure to environmental chemicals can have major negative effects on various body systems (Maamar et al., 2016; Al-Griw et al., 2017; Gassman, 2017). People are exposed to a variety of contemporary chemical substances every day, such as Bisphenol-A (BPA), parabens, phthalates, triclosan (TCS), among others, are widely referred to as endocrine-disrupting substances (EDCs). These compounds can be found in many commonplace items and interfere with natural hormonal systems on several levels, considerably resulting in dangerous medical conditions. BPA is Among the most extensively studied endocrine-disrupting substances that are controversial (Stavridis et al., 2022). BPA has particularly attracted more attention because of its extensive exposure and global distribution (Camarca et al., 2016).

BPA is one of the most widely produced industrial chemicals that are significantly used in the production of polycarbonate plastics and epoxy resins and are ubiquitous in our daily lives and surroundings. In the previous eight decades, BPA has become widespread due to its extensive use in a variety of everyday products, including food packaging linings, water pipes, electronic gadgets, drink cans, dental sealants, other medical equipment, kids toys and many more. Due to the widespread usage of plastic items, BPA has been found in human and animal food and drinking water (Kumari and Thakur, 2026a; Michałowicz, 2014; Flint et al., 2012).

BPA is discharged by food and beverage containers, which can be ingested, inhaled, or penetrated through the skin (Kumari and Thakur, 2026b; El-Missiry et al., 2014). BPA has been found in a number of human body fluids including urine, blood, and sweat and enters biological systems primarily through food and drink (Genuis et al., 2012).

Animals exposed to BPA during pregnancy, childbirth, and adulthood may be more susceptible to type 2 diabetes mellitus, hypertension, and increased serum triglycerides & cholesterol level (Rochester, 2013; Moghaddam et al., 2015). The kidneys, liver, spleen, pancreas, and lungs are among the organs that bisphenol-A targets. BPA can cause glomeruli to dilate and spread, as well as the kidney's proximal tubule epithelium to degenerate (Miyawaki et al., 2007; Alonso-Magdalena et al., 2006; Petteri, 2002; Rahimi et al., 2015).

Our earlier research showed that BPA causes reproductive toxicity (Kumari et al., 2026) and significant biochemical changes (Kumari and Thakur, 2026c) in Swiss albino mice. Building on these results, the current study assesses how BPA affects hematological parameters and body weight in order to give a more comprehensive understanding of its systemic toxicity. When taken as a whole, these studies provide thorough proof that BPA negatively impacts a variety of mouse physiological systems.

The current study was designed to examine the impacts of two distinct doses of bisphenol-A (BPA) on the body weight and hematological parameters, such as RBC count, WBC count, and hemoglobin level in male Swiss albino mice.

2. MATERIALS AND METHODS

2.1. Chemicals

Bisphenol A (≥97% pure) was purchased from HiMedia Laboratories Private Limited. Loba Chemie Private Limited, Mumbai, India, provided the remaining analytical grade chemicals and reagents.

2.2. Experimental Animal

For the current study, 40 healthy adult male *Mus musculus* weighing between 30 and 35 grams and aged between 6 and 8 weeks were acquired from the Animal House of the University Department of Zoology, T.M.B.U. Bhagalpur, Bihar. The mice were kept in polypropylene cages with wood dust on the floor. The mice were kept in typical laboratory settings with a temperature of 22 ± 2°C, a relative humidity of 50–60%, a 12-hour light and dark cycle, and the best possible food and water. Before the initiation of experiments, the mice were acclimatized for seven days to the lab environment. The experiment was carried out in compliance with the regulations set forth by the Government of India's Committee for Control and Supervision of Experiments on Animals (CPCSEA) and Institutional Animal Ethics Committee (IAEC).

2.3. Experimental protocol

The mice were separated into four groups at random, with ten mice in each group. Mice were treated with BPA orally via gastric gavage at dosages of 55 mg/kg and 110 mg/kg body weight for a continuous 28-day period (Sangai & Verma, 2012). BPA was dissolved in 95% ethanol and corn oil in the ratio 1:20 to prepare the sub lethal dose.

The groups were as follows:

Group I: Control: Double distilled water

Group II: Vehicle: Ethanol + corn oil (1:20), 0.2 mL/animal/day

Group III: BPA LD: Treated with 55 mg/kg b.w. of BPA

Group IV: BPA HD: Treated with 110 mg/kg b.w. of BPA

2.4. Sample Collection

Mice's tails were immersed in 42 °C warm water for 40–50 seconds to expand the blood vessels before sample collection. A sterile needle was used to draw blood samples from the mice's lateral tail vein. It enables a rapid and minimally invasive sampling method (Lee and Goosens, 2015).

2.5. Parameters

Body Weight: Body weight of mice was estimated using a digital weighing balance.

RBC & WBC Count: RBC and WBC counts were done using hemocytometer (Neubauer's) method (Dacie and Lewis, 1975).

Hb%: Hemoglobin concentration was evaluated by Sahli's method (Dacie and Lewis, 1975).

2.6. Statistical Analysis

To ascertain significance, data were statistically analyzed using t-test and one-way ANOVA test followed by Tukey's post hoc multiple comparison testing.

3. RESULTS

3.1. Body Weight

Table 1: Change in body weight after 28 days in control, vehicle, and BPA treated groups.

Groups	Variants	Body weight (g)		Change (%)	Significance (Initial vs Final)
		Initial (Mean ± SEM)	Final (Mean ± SEM)		
Group I	Control	33.26 ± 0.22	36.23 ± 0.22	8.93*	↑ (S)
Group II	Vehicle	33.07 ± 0.17	35.91 ± 0.27	8.59*	↑ (S)
Group III	BPA LD	34.44 ± 0.29	33.57 ± 0.60	-2.53	↓ (NS)
Group IV	BPA HD	34.31 ± 0.59	32.27 ± 0.46	-5.94*	↓ (S)

*Significance at p<0.05 (t-test)

Body weight in both control and vehicle groups were significantly increased after 28 days by 8.93% and 8.59% of initial weight respectively. There was no significant difference between the percent increase in body weight of control and vehicle groups. In BPA LD group, body weight was insignificantly decreased after 28 days by 2.53% of initial weight. However, in BPA HD group, body weight of mice was significantly decreased after 28 days by 5.94% in comparison of initial weight (as shown in table 1).

3.2. Hematological Parameters

Table 2: Effect of BPA on RBC count, WBC count, and HB% after 28 days of treatment.

Groups	Variants	RBC Count (Mean ± SEM)	WBC Count (Mean ± SEM)	Hb% (g/dL) (Mean ± SEM)
Group I	Control	5.71 ± 0.25	7.15 ± 0.23	12.77 ± 0.20
Group II	Vehicle	5.62 ± 0.17	7.28 ± 0.26	12.56 ± 0.16
Group III	BPA LD	4.27 ± 0.14*	9.58 ± 0.59*	9.64 ± 0.38*
Group IV	BPA HD	3.37 ± 0.16*	10.41 ± 0.53*	7.79 ± 0.44*

*Significance at p<0.05 (one-way ANOVA)

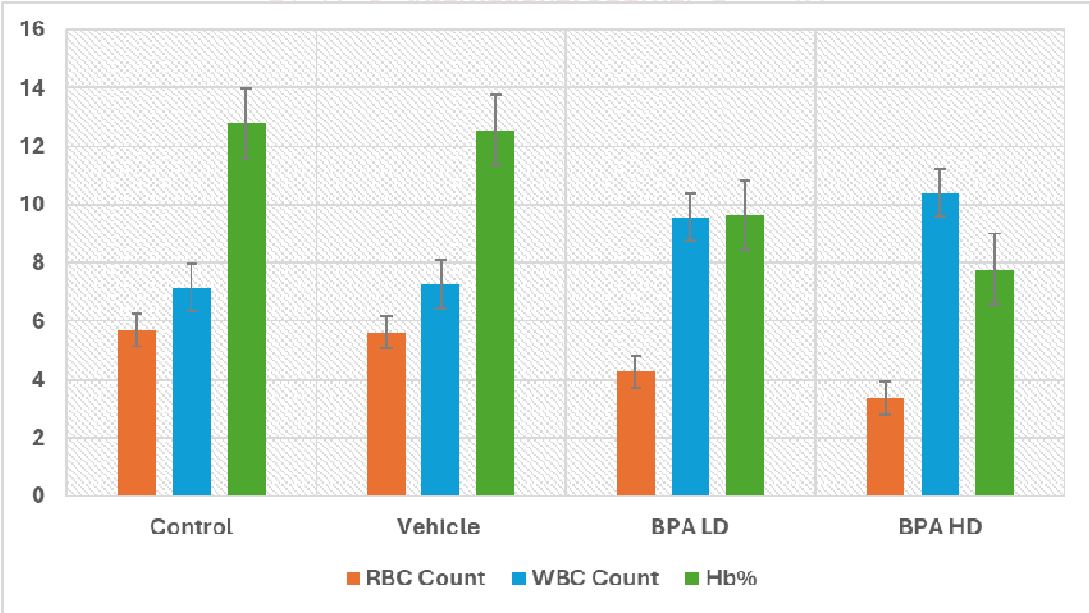

Figure 1: RBC count, WBC count, and HB% in control, vehicle, and BPA treated groups.

3.2.1. RBC Count

RBC count in both control and vehicle groups showed normal range and there was no significant difference between the RBC count of control and vehicle groups. However, in BPA LD group, RBC count was significantly decreased by about 25.22% when compared with control group. Additionally, in BPA HD group, RBC count showed large significant decrease of around 41% in comparison with control group (as shown in table 2).

3.2.2. WBC Count

WBC count in both control and vehicle groups showed normal range and there was no significant difference between the WBC count of control and vehicle groups. However, in BPA LD group, WBC count was significantly increased by about 34% when compared with control group. Additionally, in BPA HD group, WBC count showed more prominent increase of around 45.6% in comparison with control group (as shown in table 2).

3.2.3. Hemoglobin (Hb%)

Hb% in both control and vehicle groups showed normal range and there was no significant difference between the Hb% of control and vehicle groups. However, in BPA LD group, Hb% was significantly decreased by about 24.51% when compared with control group. Additionally, in BPA HD group, Hb% showed large significant decrease of around 39% in comparison with control group (as shown in table 2).

4. DISCUSSION

Nah et al. (2011) and Rajaura et al., (2025) documented a significant decrease in body weight in mice treated with BPA, which is consistent with the current findings. Sharma et al. (2021) also reported a significant decrease in body weight of male albino rats after the treatment of BPA. Oxidative stress to the liver, anorexia, a drop in serum testosterone levels, and a decrease in the relative weight of male reproductive organs, have been linked to the body weight loss.

Additional research is required to assess how exposure to BPA affects body weight because some studies have indicated that BPA has the potential to cause obesity.

Rajaura et al., (2025) parallelly reported the development of chronic haemolytic anaemia in Swiss albino mice following BPA exposure. According to Tiwari and Vanage's (2017) study, BPA has a significant impact on the development of oxidative stress in rat bone marrow, which impairs normal hemopoiesis processes because it has a significant impact on metabolic processes and damages cellular structures. Due to cell membrane damage, these alterations drastically reduce the lifespan of erythroblastic cells. The findings of Snarska et al. (2018) unequivocally show that BPA, even at low concentrations, interferes with the regular erythropoiesis processes in swine bone marrow. Chang et al. (2026) also reported aberrant iron metabolism and a higher risk of anaemia, especially in women following the exposure to BPA substitutes (BPAF, BPS, and BPF). It is well known that BPA causes excessive ROS production, which damages erythrocyte membranes oxidatively. Erythrocytes are particularly vulnerable to lipid peroxidation because of their high polyunsaturated fatty acid content and constant oxygen transport. Oxidative damage reduces the lifespan of erythrocytes and increases hemolysis, which eventually lowers the amount of hemoglobin and red blood cells in circulation (Suthar et al., 2014).

Al-Griw et al. (2023) also found that after BPA exposure, both male and female Swiss albino mice had abnormally higher WBC counts. Shaibi et al. (2022) reported that BPA exposure dramatically elevated total WBC counts in both adult male and female mice, especially lymphocytes and monocytes, when compared to control groups. The study shows that a variety of splenic tissue damages in adulthood may be caused by oxidative stress damage brought on by early-life BPA exposures.

Oxidative stress damages cells and tissues, inducing an inflammatory response (Mittal et al., 2014). Organs like the liver, kidneys, and spleen are injured by BPA exposure. An increased circulating WBC count is the result of tissue damage releasing danger signals that attract immune cells (Lopes et al., 2024). Cytokines like TNF-α, IL-1β, and IL-6 are produced in response to oxidative stress, and these cytokines aid in the production and mobilization of white blood cells from the bone marrow into the bloodstream (Li et al., 2018).

5. CONCLUSION

The current study shows that exposure to bisphenol A (BPA) causes toxic effects in *Mus musculus* that are dose-dependent. RBC count and hemoglobin levels were significantly reduced at both low and high doses of BPA exposure, indicating the development of anaemia, while body weight was significantly reduced at the higher dose. WBC counts, on the other hand, were markedly elevated at both BPA dosages, indicating an immunological or inflammatory reaction to BPA-induced toxicity. These results show that BPA negatively impacts physiological health and disturbs normal hematological homeostasis, with increased toxicity seen at higher exposure levels.

Acknowledgements

I would like to convey my profound appreciation to Dr. Ashok Kumar Thakur, my supervisor, for their guidance as well as the University Department of Zoology, T.M. Bhagalpur University, for providing all necessary laboratory facilities for the accomplishment of this experimental work.

Ethical Approval

The study followed the guidelines set forth by the Government of India's Committee for the Purpose of Control and Supervision of Experiment on Animals (CPCSEA) and the Institutional Animal Ethics Committee (IAEC).

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