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ORIGINAL ARTICLE

Effect of Bisphenol A on Some of Antioxidants in White Male Rats

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ABSTRACT

Objectives: The study aimed to determine the effect of bisphenol A on some antioxidants in white male rats.

Methods: In this experiment, 24 rats were divided into three groups of 8 replicates per group for 8 weeks. Two groups were treated orally with two different concentrations of bisphenol A, 15 and 30 mg / kg body weight. The control group was treated with corn oil. The effect of bisphenol A on serum GSH, MDA, CAT and SOD, was studied.

Results: The results showed an increase in MDA level and a decrease in GSH, CAT and SOD levels in groups treated with bisphenol concentrations compared with control group.

Conclusion: These results suggest that BPA exposure might induce oxidative stress and its complications in adult male rats.

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INTRODUCTION

Bisphenol A is a monomere that is used in the manufacture of polyacarbonate plastics and epoxy resin. Bisphenol A is an industrial compound solid, insoluble in water, colorless and has solubility in organic solvents and belongs to the diphenyl methan group. It is contain two groups of hydroxyphenyl, characterized by bisphenol half-life, but the reason for its survival in the ocean due to its continuous production, free from waste water and landfill sites and combustion and the natural breakage of plastic in the ocean[1].

The widespread use of bisphenol has made it one of the most important chemical products in the world. The global production of this substance reached 1 million tons in 1980 [1]. The global production of this substance increased to 202 million tons In 2009, where its consumption in the United States alone 856,000 tons entered the plastic industry and the manufacture of epoxy gum [2].

Bisphenol has been used in the manufacture of poly-carbon plastic since 1957 and produces 306 tons per year. It is the basis for the manufacture of epoxy gum[3, 4]. Polypropylene plastic materials are used in the manufacture of many common plastic materials such as baby feeders and water bottles, DVD, CD, glass eye lenses, mineral water pipe coating, food storage boxes, electrical appliances and other sports protective equipment [5, 6]. Less than 10% is used in the production

of fire retardants or antioxidants and bisphenol is mainly used as a fungicide [7].

Food is the most important method of exposure of humans to bisphenol by eating canned food and drinking water as the filtration of bisphenol from the plastic lining of cans of drinks and food. The filtration of bisphenol from plastic is increased when it is cleaned with a strong detergent or when it contains acidic liquids or high temperatures, and is also used in the manufacture of epoxy gum used in coating water tanks [8]. Bisphenol A is one of the most important substances that interfere with hormone function [9]. Recently, endocrine disrupting substance have been counted due to its estrogenic effect[10]. This substance can also affect thyroid function[11]. This substance is particularly important in pregnant women, infants and young children[12]. Reports in 2007 confirmed that bisphinol showed a correlation with thyroid hormone receptors, which may impede the function of these hormones[11].

Several studies have confirmed that exposure to bisphinol is associated with various disorders of the proliferative system [13]. bisphinol acts as a reproductive toxicant and causes a real risk to humanity as it weakens fertility in humans in general [14]. Exposure to bisphinol during the development of the fetus may alter the process of adding CH3 to DNA (methylation). Studies of the prostate in rats exposed to bisphinol postnatally showed genetic changes [15], while exposure to bisphinol affects the development of the forebrain in mice[16].

MATERIALS AND METHODS

Experimental design: Twenty four albino male rats *Rattus norvegicus* (weight 220 -250 g), (age 4-6 months) were used in this study. Rats were kept in the animal house, in wire-meshed stainless steel cages. The temperature in the animal house was maintained at (20-24C°), light schedule of 12:12 hours light: dark cycle with good ventilation. Animal house was provided with air vacuum, so air was changed daily during the maximum day temperature. The Rats were given pellet diet and water ad libitum. The animals were kept for one week before starting the experiment for acclimatization.

Chemicals: Bisphenol A solution was prepared by dissolving bisphinol A in corn oil weekly according to the dose to be given to each group of rats given bisphinol a .The oral LD50 of BPA in rats was 3250 mg/kg bw as reported by MSDS [17].

rats were divided to three groups (each group consist of eight rats) as follow:

1. Group I: was given vehicle (corn oil) 0.5 ml/day orally and used as control.

2. Group II: was given 15mg/kg/bw Bisphenol A orally for a duration of 8 consecutive weeks.

3. Group III: was given 30mg/kg/bw Bisphenol A orally for a duration of 8 consecutive weeks**.**

Blood Sampling: After the experiment was over, animals were sacrificed and the blood was drawn by using heart puncture and collected from rats into a clean tubes. The blood was centrifuged at 3000 rpm for fifteen minutes to separate the serum. The separated serum was stored at (-20C°) for measurement of biochemical parameters such as, malondialdelyde (MDA), glutathione, superoxide dismutase and catalase.

Assessment of MDA concentration: MDA was measured according to method of [18].

Assessment of total GSH: GSH was measured according to method of [19].

Assessment of antioxidant enzyme activities: SOD was estimated according to method of[19]. GPX was estimated according to method of Paglia and Valentine[20]. CAT activity estimation was based on the spectrophotometric method of Aebi [21].

RESULTS

The results showed a significant increase (P<0.05) in the level of serum MDA while serum levels of GSH exhibited significant decrease (P< 0.05) in the rats after oral treatment of both doses (15 and 30 mg/kg bw) of BPA for 8 weeks compared to control group, Table 1.

Table 1: **Effect of BPA on serum MDA and GSH levels in rats.**

Groups	MDA µmol/L	GSH µmol/L
Group I control	1.76 ± 0.33 b	16.90 ± 0.24 a
Group II	4.24 ± 0.42 a	12.15 ± 0.13 b
Group III	3.67 ± 0.83 a	12.95 ± 0.25 b

Data represent means ± SE

The different letters in the same column indicate a significant difference ($p < 0.05$) between groups each parameter.

The results of serum levels of SOD, and CAT exhibited significant decrease (P< 0.05) in the rats after oral treatment of both doses (15 and 30 mg/kg bw) of BPA for 8 weeks compared to control group, Table 2.

Table 2: **Effect of BPA on serum SOD and CAT levels in rats.**

Groups	SOD µmol/L	CAT U/ml
Group I control	0.043 ± 0.0021 a	0.92 ± 0.14 a
Group II	0.030 ± 0.0024 b	0.41 ± 0.1 b
Group III	0.022 ± 0.0022 b	0.31 ± 0.12 b

Data represent means ± SE

The different letters in the same column indicate a significant difference ($p < 0.05$) between groups each parameter.

Discussion

This results are agreed with Moghaddam and his group[22] observation that there were a significant increase in serum MDA level and significant decrease in serum GSH, TAS, SOD and CAT levels of peritoneal injected rats with bisphenol A in concentrations 0.5 and 2 mg/ kg bw for 4 Weeks**.**

Ozaydin *et al.*[23] found that oral administration of rats with 5, 50, and 500 µg/kg/bw doses of BPA for 8 weeks caused a significante decrease in the levels of GSH, SOD, GPx and CAT with increase in the levels of TBARS and NO in plasma.

Also Song *et al.*[24] showing that there was a significant decrease in the serum SOD activity and increase in the serum MDA level in puberty stage after treatment of rats in offspring stage with 10 mg/ml BPA. Also, they observed at adult stage there was a dose-dependent decrease in the activity of serum total antioxidant capacity. Abdel-Wahab [25] suggested that elimination of ROS induced by BPA decreased levels of antioxidant enzymes.

Oxidative stress is a state of imbalance between oxidants and antioxidants in favor of oxidants causing significant cellular damage [26]. Free radicals play an important role in cellular damage resulting from the use of toxic chemicals, which can lead to cell death [27]. In addition to the development of many diseases [28].

MDA represent the main product of lipid peroxidation and caused cellular damage because of its ability to bind covalently with essential biomolecules like lipids, proteins and nucleic acids [29].

The reduction in the level of glotathione may be due to the occurrence of oxidative stress caused by continuous treatment of bisphenol A .GSH has active participation in preventing oxidative stress either through direct removal of free radicals or by the enzymes such as glotathione peroxidase, that leading to an increase in consumption of glotathione and its transformation into an ineffective form of disulphate [30]. Thiol (sulfahydryl) group in the structure of glotathione is a well reduced factor that easily releases the hydrogen atom because of the weak bond between sulfur and hydrogen (SH) and the kinetic strength of CH in the free radicals so it protects membranes from oxidative damage and is consumed when combined with free radicals [31]. BPA decreased serum GSH level, which might suppress the GSH/GSSG ratio and increase lipid peroxidation [32].

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