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PROTECTIVE EFFECT OF TOCOPHEROL AGAINST MERCURIC CHLORIDE TOXICITY ON BLOOD PARAMETERS

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ABSTRACT

Mercury is a naturally occurring element that may exist in elemental, inorganic or organic form and in various oxidation states. Mercury is widely used in thermometers, thermostats, mercury arc lamps, mercury vapor lamp, mirror, extracting gold and silver from ores, electric rectifiers, dental amalgams for filling teeth, ointments, disinfectants, antiseptics, etc. while inorganic mercury salt i.e. mercuric chloride is commonly used in agriculture as fungicide. Mercury may enter inside the body through inhalation, skin contact or ingestion by contaminated food or water. Antioxidants are chemicals that diffuse free radicals and other damaging molecular fragments in the body. During normal cellular metabolism, damaging byproducts is created. Antioxidants counteract these cellular byproducts, called free radicals and bind with them before they can cause damage. If left unchecked, free radicals may cause heart damage, cancer, cataract and a weak immune system. Vitamin E is an antioxidant for the present study, an essential fat-soluble vitamin which includes eight naturally occurring compounds. The most active form of Vitamin E is α-Tocopherol. In the present study effect of Tocopherol against Mercuric chloride was studied for which four simultaneous groups of rats were treated with mercuric chloride (0.3mg/ml), tocopherol (0.5 ml/day), mercuric Chloride & tocopherol and control. Hematological parameter like Hemoglobin percentage and blood sugar was studied. Result reveals that due to mercuric chloride hemoglobin percentage and blood sugar were lowered, but when they treated with tocopherol slight recoupment was noticed at earlier duration and it is believed that for longer duration moderate recoupment will be observed in various hematological parameters.

INTRODUCTION: Mercury is a heavy metal used in wide variety of products and processes including pressure sensitive devices (thermometers, barometers), electrical apparatus (wiring, switches, and batteries), paints, pharmaceuticals and production of various chemicals [1]. Absorption, distribution, metabolism and excretion of mercury are dependent upon its form and oxidation state [2]. Organic mercurial are more readily absorbed than inorganic forms. Mercuric salts are usually more toxic than mercurous salts [3].

Intake of mercury causes violent corrosive effects on skin and mucous membranes, severe nausea, vomiting, abdominal pain, bloody diarrohea, kidney damage, inflammation of mouth and gums, swelling of salivary glands, excessive flow of saliva, loosening of teeth, depression, irritability, nervousness, dementia, loss of motor coordination, emotional instability, reproductive failure, dysentery, excessive perspiration, insomnia, sense of constriction, etc [4]. Vitamins E, Vitamin C, α-Lipoic acid, Co Q10, Astaxanthin are some antioxidants. Vitamin E is an essential fat soluble vitamin [5, 6].

It includes eight naturally occurring compounds in two classes designed as tocopherols and tocotrienols. Under tocopherol α- tocopherol, β- tocopherol, γ-tocopherol and δ-tocopherol are included while α – tocotrienol, β-tocotrienol, γ-tocotrienol and δ-tocotrienol comes under tocotrienol. Tocopherol contains saturated phytol side chains and tocotrienol have 3 double bonds in the side chain. The most active form of vitamin E is α-tocopherol, a 6-hydroxychroman derivative with methyl groups in position 2, 5, 7 & 8 and a phytyl side chain attached at carbon 2 [7]. Vitamin E is a powerful antioxidant, protects cells from oxidation and neutralizes unstable free radicals, which can cause damage [8]. Vitamin E giving up one of its electron to the electron deficient free radicals making it more stable. While Vitamin E performs its antioxidant functions, it also protects the other antioxidants from being oxidized. Vitamin E is found in nuts, oils, vegetables, sunflower seeds, whole grains, spinach, wheat oil, asparagus, avocado, beef, seafood, apple carrots, etc.

MATERIALS AND METHODS:

Test material used:

- **Mercuric Chloride:** Mercuric Chloride of Central Drug House (P) Ltd, New Delhi. It is heavy colourless crystalline powder, having molecular weight 271.5

- **Tocopherol:** DL-α-Tocopherol acetate of Central Drug House (P) Ltd, New Delhi. It is also known as Vitamin E acetate, having molecular weight 472.76. Its chemical formula is $C_{31}H_{52}O_3$. It is a clear viscous liquid insoluble in water, freely soluble in Acetone, Chloroform, Ether and vegetable oils, less readily soluble in menthol and 95% Ethanol.

Animal used: Female albino rats of ***Sprague Dawley*** strain weighing about 150-200 gm were used for study. They were fed with standard rat pellated diet (Amrut, Feeds, Pranav Agro Industries LTD, Sangli) and water *ad-libitum* and maintained under hygienic standard laboratories condition; temperature maintained at 24-28^{0}C and relative humidity at 60-70%.

Acute toxicity study: The experiment was initiated only after approval by the Animal Ethics Committee (IAEC/CPCSEA-716/02/9). The rats were grouped into four I, II, III and IV: control; mercuric Chloride (dose-1ml of 0.3mg/ml concentration); DL-α-Tocopherol acetate (0.5ml/day) and combination of mercuric Chloride & tocopherol for 5 and 7 days. Mercuric

Chloride was administered subcutaneously while tocopherol was administered orally.

Haematological studies: The animal was anaesthetized after 24 hours of last treatment. Blood was collected by puncturing from vein of eye. Blood was collected in a vial rinse with anticoagulant. Blood sugar was estimated by the method of Asatoor and King (1969) [9], while haemoglobin percentage was estimated by Sahli's apparatus.

Statistical Analysis: The data are presented as the Mean±S.E. Results were analyzed statistically using one way Analysis of one way Variance (ANOVA) followed by Turkey's multiple Comparisons test. The minimum level of significance was set at P<0.05.

OBSERVATIONS:

TABLE 1: SHOWING LEVEL OF BLOOD SUGAR AT VARIOUS DURATIONS

Duration	Control	Experimental (After treatment)		
		Mercuric Chloride	DL-α-Tocopherol acetate	Mercuric Chloride & Tocopherol
5 Days	104.8±2.25	109.7±2.6*	100.6±2.6*	101.7±1.56
7 Days	101.3±1.68	112.5±4.6*	94.7±0.74	97.3±1.0*

(Values expressed as Mean ± S. E. where n=6); *Statistical analysis: P Vs respective control< 0.05

TABLE 2: SHOWING HAEMOGLOBIN PERCENTAGE AFTER VARIOUS DURATIONS

Duration	Control	Experimental (After treatment)		
		Mercuric Chloride	DL-α-Tocopherol acetate	Mercuric Chloride & Tocopherol
5 Days	11.86±1.44	7±0.22	11.1±0.26	9.26±0.73
7 Days	11.76±0.19	7.33±0.45	11.9±0.16*	9.16±0.42

RESULTS:

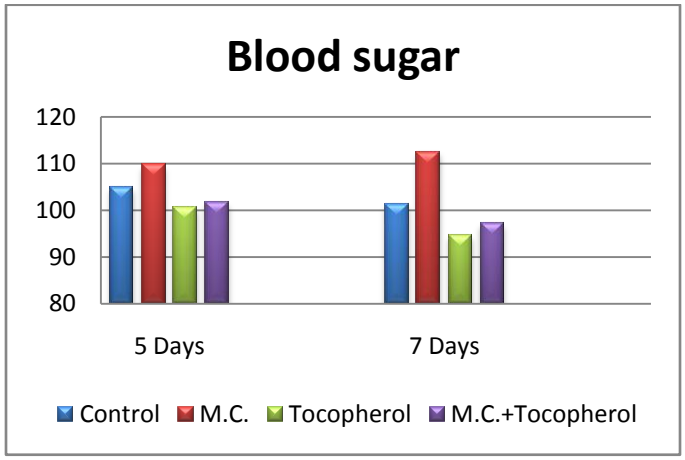

FIG. 1: BLOOD SUGAR LEVEL AT DIFFERENT DURATION IN FEMALE ALBINO RATS

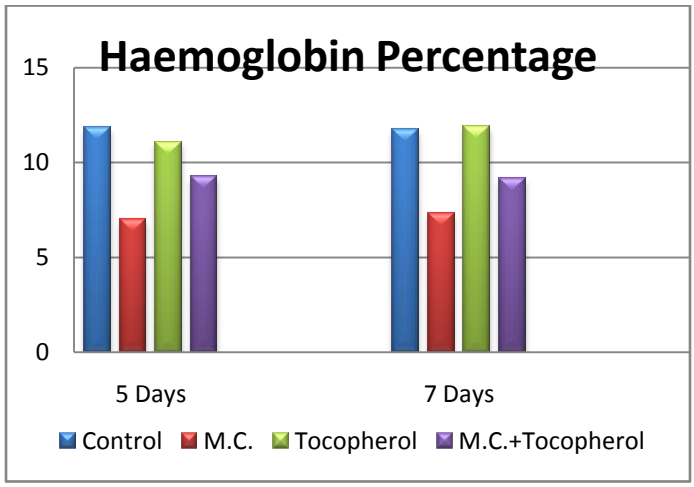

FIG. 2: SHOWING HAEMOGLOBIN PERCENTAGE AT DIFFERENT DURATION IN FEMALE ALBINO RATS

DISCUSSION: Mercuric Chloride is one of the most toxic substances encountered. The extreme toxicity of mercury can be seen from documented effects on very low levels of mercury exposure. In present study, we studied protective effect of tocopherol (Vitamin E) against mercuric Chloride toxicity on blood sugar and haemoglobin percentage. Mercuric Chloride is an industrial agent known to cause autoimmune disorder, etc. Results of studies showed that mercuric Chloride treated groups

are showing very significant increase in the blood glucose level of albino rats(Graph 1) because Mercuric Chloride generally increases the level of circulating hormones in adult albino rats [10]. Similarly, E I Demesdash *et al* (2004) has also reported that cadmium induces changes in blood hematological and biochemical parameters; they reported significant increase in glucose level. However he has also studied the effect of Aluminium Chloride in rats against Vitamin E as an antioxidant, which also increases the concentration of glucose. Similar results were observed in present study also. Other groups of rats, which are treated with Vitamin E showed decreases concentration of blood glucose because Vitamins E act as a good antioxidant agent and is having tendency to overcome the toxicity of any heavy metal. However, Yousef *et al* (2004) reported changes in haemato-biochemical parameters, of male rabbits due to aluminium and also protective role of Ascorbic acid against it.

The hemoglobin percentage was decreased due to Mercuric Chloride in albino rats (Graph 2) because hemoglobin is the molecule which transport oxygen to body tissues However, heavy metals disturbed the formation of hemoglobin due to which their percentage level is decreased in the blood. Similar results were observed by Mathur *et al* (2002). However, Christersen *et al* (1977) was reported that there were significant decreases in hemoglobin percentage after exposure to lead at 59 µg/liter or more after two and eight weeks. Thus, it could be concluded that mercuric Chloride is highly toxic compound; which causes increase in blood glucose level and decrease in hemoglobin percentage while tocopherol is a good antioxidant that can overcomes the mercuric Chloride toxicity to certain extent.

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