BRIEF COMMUNICATION

A BIOCHEMICAL STUDY ON VARIABILITY OF SUPEROXIDE DISMUTASE, CATALASE AND GLUTATHIONE PEROXIDASE IN DRY CLEANERS

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ABSTRACT

Several chemicals which induce cytotoxicity are broadly classified into three types and they are organophosphate, organochlorine and carbamate compounds. Perchloroethylene has been clearly identified as a carcinogen in experimental animals and it's a very common carcinogen used for dry clean purpose. Hence, in the present study, blood samples from dry cleaners were taken, Superoxide dismutase, Catalase and Glutathione peroxidase activity was estimated in blood samples of dry cleaners. There was a significant increase in the activity of Catalase, Glutathione Peroxidase, Superoxide Dismutase in dry cleaners of chronically exposed to perchloroethylene as compared to controls. The increased activities of antioxidant enzymes may be a compensatory regulation in response to increased oxidative stress induced by perchloroethylene.

KEY WORDS

Perchloroethylene, Antioxidant enzymes, Dry cleaners, Catalase, Glutathione Peroxidase, Superoxide Dismutase

INTRODUCTION

The carcinogenic activity of perchloroethylene (PCE) is very high in comparison to organophosphate, organochlorine and carbamate compounds. PCE has been mainly used in dry cleaning and textile industries, which is a chlorinated hydrocarbon. It accounts for 80-85% of all dry cleaning fluid used. PCE, is also known as tetrachloroethylene, is a colourless, nonflammable liquid of low acute toxicity.

Free radicals are highly reactive entity and very short lived molecules. Although free radicals perform some useful functions, they are toxic when generated in excess. The most important characteristic of toxic free radical either *in vivo* and *in vitro* is the peroxidation of lipids resulting in tissue damage and death (1). PCE is known to produce membrane damage through increased lipid peroxidation. These results suggest

that PCE induced cellular damage may be associated with lipid peroxidation. The antioxidant enzymes like superoxide dismutase, catalase, glutathione peroxidase play an important role in the protection of cells against free radical mediated tissue damage (2). Superoxide dismutase (SOD:EC.1.15.1.1) catalyses dismutation of superoxide anion into hydrogen peroxide (H_2O_2). Both catalase, (CAT:EC1.11.1.6) and glutathione peroxidase (GPX:EC1.11.1.9) activity detoxifies hydrogen peroxide.

The aim of the present study is to examine antioxidant levels in dry cleaners affected by PCE.

MATERIALS AND METHODS

Sampling : The area chosen for this study was pallavaram (dobby gana), Chennai (India), 10 male drycleaners ranging in age from 25-35 years, using PCE for drycleaning purpose, atleast 6 hr per day for the last 10 years. All the participants free from any evidence of organic disease were selected for this study. Control group consisted 10 healthy male blood donors aged 25-35 years. Blood was collected from antecubital vein. The hemolysate was used for determination of activity

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of SOD, GPx and CAT.

SOD activity was measured by the method of Marklund and Marklund (3). The activity was expressed as U/ml of blood. CAT was measured colorimetrically (4) and expressed as kU/g of Hb. GPx Activity was measured by the method of Ellman (5) and expressed as U/g of Hb.

RESULTS AND DISCUSSION

Table 1 : Comparison of activities of erythrocyte SOD, catalase, glutathione peroxidase of dry cleaners and control group.

Parameters	Controls (n = 10)	Workers (n = 10)	Normal reference range
SOD(U/ml blood)	21.1±2.39	41.56± 3.54*	10-30
Catalase (KU/ g Hb)	10.68 ±2.05	30.20 ±3.09*	8-18
Glutathione peroxidase (U/ g Hb)	20.26± 2.26	30.05 ±3.24*	10-27

Values are expressed as Mean ± SD; n = 10

Significantly different from control group at *p < 0.05.

The result of present study indicates a significant increase in antioxidant enzymes in drycleaners exposed to PCE. This is evident from the observations given in Table that the drycleaners registered increased levels of SOD, CAT and GPx as compared to controls. The increased activity of these enzymes reflects a compensatory regulation to counteract oxidative stress perhaps created due to increase generation of oxy free radicals. PCE has been reported to produce cellular damage through lipid peroxidation. However the mechanism is not fully understood. There are studies suggesting the role of PCE in biological toxicity through free radical generation. The metabolism of PCE is mediated through cytochrome P₄₅₀ catalyse oxidation reaction which inturn produce reactive epoxide intermediates (6). Oxidative stress plays an important role in the toxicity of various xenobiotics, including organochlorine and organophosphate chemicals. Mechanism of PCE induced cytotoxicity is not known, data from PCE metabolism studies suggest a role for free radicals in its biological toxicity. The major pathway for the epoxide intermediate involves nucleophilic attack by water or enzymatic reduction by epoxide hydrase. Another potential source for reactive oxygen metabolites involves the effect of trichloroacetic acid (TCE) on peroxisomes. TCE is an important metabolite of PCE that has been shown to induce erythrocyte peroxisome proliferation (7). The increase in hydrogen peroxide and its much more reactive Haber-weiss reaction product hydroxyl radicals can produce a variety of biomolecular damages including lipid peroxidation and protein

oxidation. Erythrocyte are particular sensitive to oxidative stress and supplied by protective defense system in order to counteract excess ROS. Therefore free radicals are scavenged by high SOD, GPx and CAT (8).

Oxidative redox parameters such as erythrocyte SOD, CAT and GPx are significantly increased after prolonged exposure to chemicals like organochlorine and organophosphate (9).

Supporting the present findings there are evidence that in chronic poisoning with organophosphate, SOD and GPx and CAT increases (10).

Thus the present study indicates oxidative stress due to PCE exposure among dry cleaners and increased activity of antioxidant enzymes may be a compensatory regulation in response to increased oxidative stress.

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