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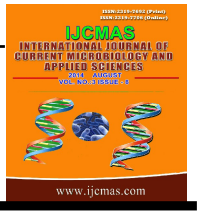


Original Research Article

Assessment of Vitamin E and Vitamin C against silica intoxication

Shruti Saxena*

SGRR (PG) College, Dehradun, India
**Corresponding author*

Keywords

Silica; vitamin E; vitamin C; biochemical parameter; cholesterol.

A B S T R A C T

The aim of the present study was to observe the alteration of blood and also to show whether therapeutic agents used in study may provide recovery against exposure to silica. In this study, silica was administered as silicon dioxide at a dose of 40 mg/kg for 28 days to produce toxic effect. Recovery pattern was evaluated by vitamin E + vitamin C (50 mg/kg, *ip* & 100 mg/kg, *po*). Toxicological consequences were evident by the increased activities of AST, ALT, and ALP in serum after silica administration. Level of blood sugar, blood urea, serum protein, serum cholesterol and creatinine was also increased. 5 days therapy with vitamin E + vitamin C was effective and showing preventive aspect in recouping all biochemical parameters. Our findings suggest that vitamin E + vitamin C possess protective efficacy against silica-related diseases such as silicosis.

Introduction

Silica is found in the earth's crust, in the proportion of 27.70%, and in an enormous diversity of minerals. Chronic inhalation of crystalline or free silica by workers, especially sandblasters, miners, tunnellers, silica millers, abrasives and flour workers, ceramic workers, glassmakers, and quarry and foundry workers leads to a pulmonary fibrosis called silicosis (Ellenhorn *et al*., 1997). Exposure is associated with many other different disorders besides pulmonary silicosis, such as progressive systemic sclerosis, emphysema, systemic lupus erythematosus, rheumatoid arthritis, dermatomyositis, glomerulonephritis and vasculitis (Stratta *et al*., 2001; Merget *et al*., 2002).

It was found that lactate dehydrogenase, b-glucuronidase, N-acetylglucosaminase, and total protein levels increased in animals instilled with silica fluid in a dose-related manner (Lindenschmidt *et al.*, 1990).

It is one of the fat soluble vitamins, required by many species for normal reproduction, normal development of muscles, normal resistance of RBC to haemolysis and a series of other physiological and biochemical functions it was found that vitamin E has beneficial in treating heart ailments. Oxidative damage has been implicated in a number of neurological disorders and diseases. The importance of vitamin E in maintaining neurological structure and

function has been well documented in clinical research (Packer and Landvik, 1989). Supplementation of vitamin E serves as an effective method of preventing membrane damage caused by oxygen radicals (Halliwell *et al*., 1992).

Altuntas *et al*., 2002, reported the toxicity of organophosphate insecticide methidathione on lipid per-oxidation and anti-oxidant enzymes and the ameliorating effects of a combination of vitamin E and vitamin C. Vitamin E is a naturally occurring, potent lipid-soluble, chain-breaking antioxidant that scavenges reactive oxygen species and lipid peroxyl radicals both in vitro and vivo (Kir et al., 2005 and Arreola-Mendoza *et al.*, 2006). It protects the integrity of membrane by inhibiting lipid peroxidation and augmenting the activity of antioxidant enzymes in the kidney of diabetic rats (Kedziora-Kornatowaska *et al.,* 2003) and is also shown to suppress oxidative stress in rat remnant kidney (Hahn *et al.,* 1999).

Materials and Methods

Female albino rats weighing 150±10 g. were selected for the study were housed under standard conditions (25°±2°C temp, 60-70% relative humidity and 12 h photoperiod) and allowed to food and water *ad libitum*. Experiments were conducted in accordance with the guidelines set by Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) Chennai, India.

Silicon di-oxide (Sio_2, Vitamin E and Vitamin C were procured from Sigma chemicals Pvt. Ltd. (USA). Vitamin E was dissolved in olive oil and vitamin C was dissolved in distilled water.

The dose of toxicant, SiO_2 was prepared in normal saline. Vitamin E was dissolved in olive oil and vitamin C was dissolved in distilled water.

All results were expressed as means ± SE. Comparisons between two independent groups were made by the Students T test and $P<0.05$ was considered statistically significant. The Statistical Package for the Social Sciences (SPSS) packed program for Windows was used for the statistical analysis.

Results and Discussion

The present study showed alterations in the various blood parameters after intraperitoneal intoxication of silicon dioxide. Increased level of blood sugar, serum cholesterol, transaminases, serum alkaline phosphatase and serum proteins were found due to silica exposure for 28 days. Therapeutic agents *i.e.* vitamin E + vitamin C recouped the values to normal control.

The mean blood sugar level of the various groups of rats receiving 40 mg/kg silica as silicon dioxide exposed rats was statistically higher from the level of basal control animals. Therapeutic agent i.e. vitamin E + vitamin C.recouped the values to normal control.

The deposition of silica particles in the lungs of man and experimental animals leads to silicosis, an industrial era disease. The relationship between crystalline silica and silicosis, a non-malignant fibrosis of the lung, has been known for decades (Ulm et al 2004). Although the enzyme catalyzed reactions takes place within the living cells but on exposure to certain toxicants, the enzymes leak out through the cell membrane into circulation. In the present investigation, daily administration of silicon dioxide at a dose of 40 mg/kg for 28 days showed

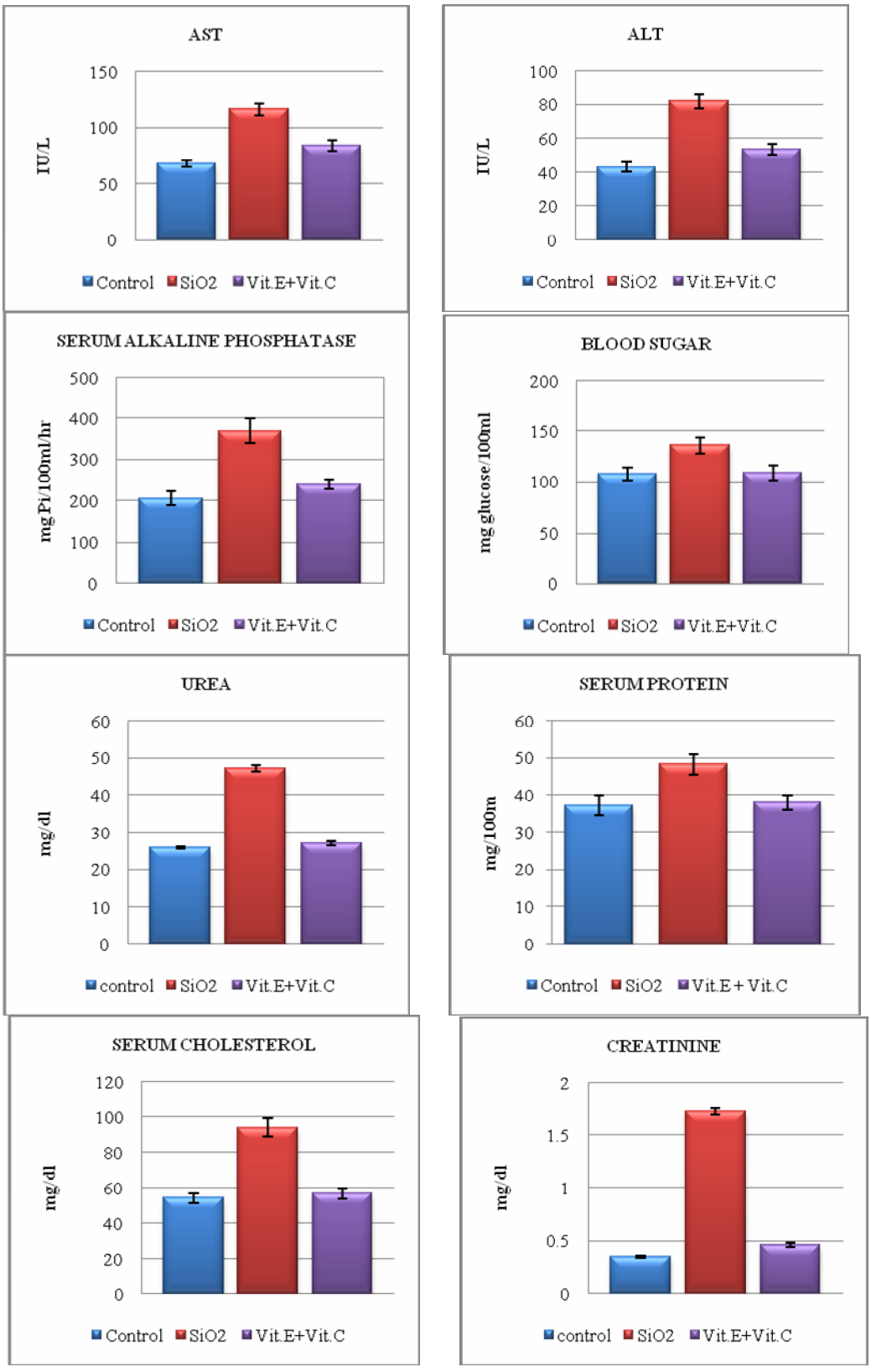
significant increase in the serum transaminases activity may be due to phagocytosis and necrosis of liver. These findings are substantiated by other authors after administration of toxic compounds (Janbaz *et al*.,1995; *Edwards et al*., 1993; Saraswat *et al*., 1999). Combination of vitamin E + vitamin C restored the elevated activities of transaminases. It seems that these vitamins protect the cellular membranes from oxidative degeneration caused by toxicant, as vitamin E and vitamin C are well known antioxidants (Toit *et al*., 2001). Vitamin E is lipophilic in nature so it easily penetrates the cell membrane and breaks oxidative chain reactions occurring in phospholipids of cell membrane. Similarly, due to hydrophilic nature of vitamin C it passess into cytosoles where it reduces oxidative stress occurring due to xenobiotic. Hence, the combination of these vitamins ultimately maintains the integrity of plasma membrane and which eventually check the leakage of transaminases. Significant rise in the level of blood sugar, serum protein and serum cholesterol were found after sub chronic exposure of silica. These elevations in the level of blood sugar and serum cholesterol may be due to dysfunctional and dystrophic changes in liver after administration of toxic compounds. When the treatment of vitamin E + vitamin C was given to these silicotic rats, this elevated level was significantly decreased.

Table.1

PARAMETERS	**CONTROL**	**SiO2**	**VIT E+ Vit C**
AST (IU/L)	68.0 ± 3.12	116 ± 5.55	84.0 ± 5.17
ALT (IU/L)	43.2 ± 2.58	82.0 ± 4.14	53.5 ± 3.05
ALP (mg Pi/100ml/h)	206 ± 15.8	370 ± 30.1	239 ± 12.2
S-PROTEIN (mg/100ml)	37.3 ± 2.64	48.2 ± 2.78	38.0 ± 1.96
BLOOD SUGAR (mg/100ml)	108.0 ± 6.70	136.0 ± 7.60	109.0 ± 7.44
CHOLESTEROL (mg/dl)	54.3 ± 2.73	94.0 ± 4.99	57.0 ± 2.97
UREA (mg/dl)	26±0.31	36±0.93	27±0.5
CREATININE (mg/dl)	0.35±0.01	0.71±0.04	0.46±0.02

Values are expressed as mean± SE; P values SiO_2 Vs control at a≤0.05, b≤0.01 P value Drugs Vs SiO_2 at c≤ 0.05, d≤0.01

Graph.1


AST
IU/L
150
100
50
0
Control
SiO2
Vit.E+Vit.C
ALT
IU/L
100
80
60
40
20
0
Control
SiO2
Vit.E+Vit.C
SERUM ALKALINE PHOSPHATASE
mg Pi/100ml/hr
500
400
300
200
100
0
Control
SiO2
Vit.E+Vit.C
BLOOD SUGAR
mg glucose/100ml
200
150
100
50
0
Control
SiO2
Vit.E+Vit.C
UREA
mg/dl
60
50
40
30
20
10
0
control
SiO2
Vit.E+Vit.C
SERUM PROTEIN
mg/100m
60
50
40
30
20
10
0
Control
SiO2
Vit.E + Vit.C
SERUM CHOLESTEROL
mg/dl
120
100
80
60
40
20
0
Control
SiO2
Vit.E+Vit.C
CREATININE
mg/dl
2
1.5
1
0.5
0
control
SiO2
Vit.E+Vit.C

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