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Research Article

Antioxidant Status of Cement Dust-Exposed Albino Rats Treated with Aqueous Extract of Turmeric

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ABSTARCT

Exposure to cement dust facilitates the reactions in which free radicals are produced in different parts of the body. The components of cement such as silica and chromium pose danger to cellular components such as proteins, nucleic acid, DNA and membrane lipid. This study was grouped into normal control, positive control, negative control and cement exposed treated group. The turmeric extract was administered for 14 consecutive days. Each dose was administered daily, 3hours after 30 minutes of exposure to cement dust. Superoxide dismutase was determined by method of sun and sigma while lipid peroxidation by Nichans and Samuelson. The concentration level of the Superoxide Dismutase was significantly reduced in negative control compared with the normal while treatment with turmeric extract increased the concentration of the superoxide Dismutase at a non significant level ($p<0.05$). Lipid Peroxidation level of the untreated (negative control) significantly increased compared with the normal control, treatment with turmeric reduced the lipid peroxidation at non significant level when compared with the negative control ($p<0.05$). There was no significant change observed in the weight of the groups of rats. Cement dust exposure doesn't affect weight. The result shows a decrease in superoxide dismutase and increase in lipid peroxidation during cement dust exposure. Turmeric root extract does not return the altered parameters to normal concentration[1-10].

Keywords: Cement dust; Lipid peroxidation; Superoxide dismutase; Turmeric

INTRODUCTION

Cement dust exposure has been associated with an increased risk of liver abnormalities, pulmonary disorders and carcinogenesis. Decreased antioxidant capacity and increased plasma lipid peroxidation have been posed as possible casual mechanisms of these diseases (Aydin, et al; 2010). Exposure to cement dust facilitates the reactions in which free radicals are produced in different parts of the body. The components of cement such as silica and chromium pose danger to cellular components such as proteins, nucleic acid, DNA and membrane lipid. Silica is one of the most documented workplace contaminants. Long term exposure to silica has been reported to be the principal cause of silicosis. A recent review estimates 8,800 silicosis death a year worldwide (Driscoll, et al;2005). Occupational exposure to dust containing crystalline silica occurs in mining, ceramics production; cement production e.t.c (A.T.S, 1997). Since the body cannot clear or metabolize a desirable portion of inhaled mineral dust particles, fibrosis develops in the upper regions of the lungs which interfere with their normal expansion. Alveolar macrophages are destroyed with fibrotic nodules forming around them. Alveolar and interstitial macrophages are activated after particle uptake and produce reactive oxygen species (ROS).

An antioxidant is a molecule that inhibits the oxidation of other molecules. Oxidation is a chemical reaction that can produce free radicals leading to chain reactions that may damage cells. Antioxidant such as thiols or ascorbic acid (vitamin c) terminates these chain reactions.

Turmeric is a rhizomatous herbaceous perennial plant of the ginger family Zingiberaceae (Priyadarsini, 2014). Turmeric has been used in Asia for thousands of years and is a major part of siddha medicine (Chattopadhyay, et al; 2004). It was first used as a dye and then later for its medicinal properties [11-20].

Throughout the orient, turmeric is traditionally used for both prevention and therapy of diseases. Modern in vitro studies reveal that turmeric is a potent antioxidant, anti-inflammatory, antimutagenic, anti microbial and anti cancer agent. Turmeric used in cooking and in home remedies has significant in cooking antioxidant abilities at different levels of actions. Studies indicate that sufficient levels of turmeric may be consumed from curries in vivo to ensure adequate antioxidant protection (Tilak, at al; 2004). As an antioxidant, turmeric extracts can scavenge free radicals, increase antioxidant enzymes and inhibit lipid peroxidation. Turmeric (100µg/ml) inhibits lipid peroxidation in renal cells against hydrogen peroxide-induced injury when incubated with cells for three hours (Cohly, et al; 1998).

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MATERIALS AND METHODS

SAMPLE COLLECTION

The fresh commercially available turmeric rhizomes were purchased from Araugo market Owerri West, Imo state. It was identified by the botanist Dr. Duru M.C. in the Department of Plant Science Federal University of Technology Owerri.

PREPARATION OF TURMERIC EXTRACT

The rhizomes of the turmeric plant were washed with clean water and air dried, then grounded to a powdered form with the help of a grinder followed by extraction of the active ingredient through aqueous extraction. The final product obtained was transferred to a glass specimen bottle to be used for the experiment [21-30].

EXPERIMENTAL ANIMAL

A total of 20 albino rats of both sexes weighing 68-72g were obtained from a local breeder in Owerri for the study. The animals were housed in cages with saw dust as bedding and they were maintained under normal conditions of temperature (12 hours light and 12 hours darkness cycle). During the 7 days acclimatization, the animals had free access to animal finishers' feed and clean water.

ADMINISTRATION OF EXTRACT

The aqueous extracts were administered orally to threats using oragastic tube. Threats were exposed to the cement dust before the experiment for 14 days.

ADMINISTRATION OF THE EXTRACT ON THE ANIMALS

The experimental animals were grouped into five and each group contained four animals as follows

Group 1 normal control	Not exposed to cement dust and Not treated
Group 2 positive control	Not exposed to cement dust but treated with extract
Group 3 negative control	Exposed to cement dust but not treated with extract
Group 4 treated with extract	Exposed to cement dust and treated with 100mg/kg b.w of turmeric
Group 5 treated with extract	Exposed to cement dust and treated with 200mg/kg b.w of turmeric

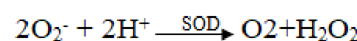
The turmeric extract was administered for 14 consecutive days. Each dose was administered daily, 3hours after exposure. The animals were sacrificed after 24 hours of the last dose, under anesthesia with diethyl ether, blood samples were collected directly from the heart. The cold centrifuge machine was used to separate the serum. The blood samples were centrifuged at 400rpm for 15 minutes.

BIOCHEMICAL ANALYSIS

Determination of Superoxide Dismuatse (SOD):

The method of Sun and Sigma as directed by Ogbunugafor et al; (2010) was adopted.

Principle: Superoxide dismutase activity was determined by its ability to inhibit the autoxidation of epinephrine. The rate of the reduction with superoxide is related with epinephrine activity and is inhibited by superoxide dismutase. Epinephrine is reduced by the superoxide radical. The rate of reduction is followed spectrophotometrically at 480nm. Superoxide dismutase inhibits the reduction of epinephrine by competing for the superoxide radical.



Procedure: The reaction mixture (3ml) contained 2.95ml, sodium carbonate buffer (0.05M, pH 10.2), 0.02ml of Serum and 0.3ml of epinephrine in 0.005N Hcl used to initiate the reaction. The reference curette contained 2.95ml buffer, 0.03ml of substrate (epinephrine) and 0.02ml of water. An extinction coefficient of 480nm of 4020m-1cm-1 was used in calculating activity [31-40].

Determination of lipid peroxidation index: Lipid peroxidation in plasma was estimated by the method of Nichans and Samuelson (1968).

Principle: Lipid peroxidation was ascertained by formation of malondiadehyde (MDA) and measured by thiobarbituric reactive (TBARS) method .

Procedure: 0.1ml of plasma was treated with 2ml of (1:1:1 ratio) TBA-TCA HCL reagent (TBA 0.37%: 0.25N HCL: 15% TCA) and placed in water bath for 15mins, cooled and centrifuged and then clear supernatant was measured at 535nm against reference blank. Malondiadehyde (MDA) which is an index of LPO was calculated with extinction coefficient of 1.5 X 105M-1cm-1.

PRESENTATION OF RESULTS AND STATISTICAL ANALYSIS

All the data obtained were expressed as mean ± SEM in a table and a value of P<0.05 was considered statistically. Statistical analysis was performed by one-way analysis of variance (ANOVA) to assess the significant differences between controls and treated ones (rats).

RESULT

GROUPS	SUPEROXIDE DISMUTASE (IUX104)
NORMAL CONTROL	1.91±2.32ab
POSITIVE CONTROL	3.72±2.49b
NEGATIVE CONTROL	0.24±0.11a
Albino rats exposed to cement dust and treated with 100mg/kg body weight of turmeric	0.62±1.24a
Albino rats exposed to cement dust and treated with 200mg/kg body weight of turmeric	1.24±1.43ab

Table 4.1: The effect of cement dust on superoxide dismutase.

Superscript on the same column with different alphabets are significantly different from each other (P<0.05). (n±SD)n is the mean of 5 rats and SD is the standard deviation. The effect of the cement dust on the superoxide dismutase of the untreated (negative control) was reduced non significantly when compared with the normal control. Treatment with turmeric increases the concentration of the superoxide dismutase at a non significant level.

GROUPS	LIPID PEROXIDATION (mg/Ix10-7)
NORMAL CONTROL	0.15±0.05a
POSITIVE CONTROL	0.22±0.09a
NEGATIVE CONTROL	10.50±2.11b
Albino rats exposed to cement dust and treated with 100mg/kg body weight of turmeric	8.85±7.80b
Albino rats exposed to cement dust and treated with 200mg/kg body weight of turmeric	6.13±7.40ab

Table 4.2: The effect of cement on lipid peroxidation.

Superscript on the same column with different alphabets are significantly different from each other (P<0.05). (n±SD)n is the mean of 5 rats and SD is the standard deviation. Effect of cement dust on the untreated (negative control) significantly increased the lipid peroxidation when compared with the normal control. Treatment with turmeric at 100 and 200 mg/kg reduced the lipid peroxidation at non significant level when compared with the negative control [41-46].

GROUP	WEIGHT (g)
NORMAL CONTROL	82.31±1.05ab
POSITIVE CONTROL	87.57±4.18a
NEGATIVE CONTROL	77.23±9.12a
Albino rats exposed to cement dust and treated with 100mg/kg body weight of turmeric	89.15±7.20a
Albino rats exposed to cement dust and treated with 200mg/kg body weight of turmeric	87.31±2.45a

Table 4.3: Effect of cement dust on weight.

Superscript on the same column with different alphabets are significantly different from each other (P<0.05). (n±SD)n is the mean of 5 rats and SD is the standard deviation. There was no significant difference between the weights of the groups therefore; cement dust exposure does not affect weight.

CONCLUSION

The antioxidant status in cement dust exposed Albino rats treated with turmeric (Curcuma longa) aqueous extract was determined in this project. The study has shown the effect of cement dust on the following: superoxide dismutase (SOD), Lipid peroxidation and weight of the exposed albino rats; as well the effect of turmeric extract used in treatment on the listed parameters.

This study however shows that there is significant association between particulate air pollution and biomarkers of oxidative stress. These associations suggest that personal exposure to fine particles in ambient air can lead to changes and damage to several components of the cell.

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