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# Assessment Of Essential Trace Elements, Acute Phase Reactants, And Biochemical Parameters In Stone Mine Workers And Healthy Controls In Western Rajasthan"

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**Introduction:** Silicosis is a serious lung disease caused by long-term exposure to crystalline silica dust in the workplace. The risk and development of silicosis are significantly influenced by the mineral composition of work environments.
**Aim:** The aim of this study is to evaluate the connection between mineral content in industrial environments and the likelihood of developing silicosis.
**Methodology:** This is a comparative cross-sectional study designed to assess the levels of essential trace elements, acute phase reactants, and biochemical parameters in stone mine workers and healthy controls in the western Rajasthan region.
**Result:** Pearson correlation indicated a significant relationship between increased occupational exposure and higher levels of copper, CRP, and ferritin, while lower zinc and vitamin D levels were also correlated with increased exposure.
In conclusion, The study revealed significant differences in essential trace elements, acute phase reactants, and vitamin levels between stone mine workers and healthy controls. The findings underscore the need for targeted health interventions to address nutritional deficiencies and monitor inflammatory markers among mine workers to mitigate health risks associated with occupational exposure.

## Introduction

Silicosis is a severe respiratory condition caused by long-term inhalation of crystalline silica dust, a prevalent danger in stone quarrying.(1) The occurrence and seriousness of silicosis are greatly impacted by the mineral composition of the mining site (2). Workers in stone mines, especially in areas such as Western Rajasthan, face an increased danger because of their prolonged contact with dangerous dust. This research project seeks to investigate how exposure to silica dust in the workplace affects the levels of essential trace elements, acute phase reactants, and biochemical parameters in stone mine workers in comparison to a group of healthy individuals. The study aims to gain a better understanding of the occupational health hazards encountered by mine workers through evaluating these health indicators (4). The results emphasizes the importance of health interventions targeting nutritional deficiencies and tracking inflammatory reactions, with the goal of decreasing the occurrence and effects of silicosis in stone mine workers.

## Methodology

The present study was a comparative cross-sectional investigation conducted in Western Rajasthan with one hundred stone mine workers and one hundred healthy participants. Each participant underwent a thorough health assessment and blood work was performed. The study employed atomic absorption spectroscopy and standard biochemical tests to assess essential trace elements (copper, zinc), acute phase reactants (CRP, ferritin), and biochemical parameters (vitamin D). The occupational exposure was assessed through structured interviews and workplace assessments, and data analysis was conducted using Pearson correlation to investigate the relationship between exposure levels and health markers. Approval was obtained in accordance with ethical guidelines, and all participants provided informed consent.

## Results

Table 1 shows the trace element levels and acute phase reactants in both stone mine workers and healthy controls. The results demonstrated significant differences between the two groups, with mine workers showing elevated levels of copper, CRP, and ferritin, while zinc and vitamin D levels were significantly lower in the exposed group.

| Parameter | Stone Mine Workers | Healthy Controls | P-value |
|---|---|---|---|
| Zinc (mg/dL) | 36.87 ± 10.43 | 42.35 ± 12.68 | <0.001 |
| Copper (mg/dL) | 186.75 ± 30.65 | 132.68 ± 40.15 | <0.001 |
| CRP (mg/L) | 29.45 ± 18.34 | 10.67 ± 8.45 | <0.001 |
| Ferritin (ng/dL) | 440.75 ± 62.10 | 315.45 ± 51.80 | <0.001 |
| Vitamin D (ng/mL) | 15.32 ± 3.56 | 25.45 ± 5.12 | <0.001 |
| Vitamin B12 (pg/mL) | 136.75 ± 28.45 | 160.12 ± 31.43 | 0.024 |

The results indicated that stone mine workers had lower levels of zinc and vitamin D compared to the control group, while copper, CRP, and ferritin were elevated, indicating increased inflammatory response and possible nutritional deficiencies related to occupational exposure.

## Discussion

The results of this study are consistent with other studies on the risks of silica exposure to the workplace. Acute phase reactants, such as ferritin and CRP, were found to be elevated in mine workers; these findings suggest that there may have been a prolonged inhalation of silica dust, which may have heightened the inflammatory response. Other studies have also shown that people exposed to silica dust are more likely to develop systemic inflammation, which can worsen chronic conditions like COPD and even cause autoimmune disorders.

Zinc, an important cofactor in immune function, plays a crucial role in maintaining the body's defense mechanisms against oxidative stress. Deficiencies in zinc have been linked to increased susceptibility to respiratory infections, a known risk for individuals with silicosis. Similarly, low vitamin D levels have been linked to poor lung function and increased inflammation, further compounding the risks faced by mine workers. The observed deficiencies in zinc and vitamin D levels among stone mine workers are consistent with other occupational health studies that report trace element imbalances in people exposed to toxic minerals.

Since copper is involved in both pro-oxidant and antioxidant activities, elevated levels in mine workers are particularly concerning. Prolonged exposure to elevated levels of copper has been associated with oxidative stress and inflammation, which may contribute to the pathogenesis of lung diseases. The elevated ferritin levels in the mine workers may be the body's reaction to iron dysregulation and inflammation, both of which are made worse by prolonged exposure to silica.

Future research should concentrate on longitudinal studies to assess the long-term impact of trace element imbalances and inflammatory responses in individuals exposed to occupational hazards like silica. These findings highlight the significance of targeted health interventions to address nutritional deficiencies and monitor inflammatory markers among stone mine workers. Regular health screenings, the provision of personal protective equipment, and occupational safety training are critical measures that can help mitigate the health risks associated with silica dust exposure.

## Conclusions:

The study included 100 stone mine workers and 100 healthy controls. Significant differences were observed between the two groups' levels of important trace elements, acute phase reactants, and biochemical parameters. The copper and ferritin levels in the stone mine workers were 1.50 ± 0.35 mg/L and 220 ± 50 ng/mL, respectively, and higher C-reactive protein (CRP) levels (average ± standard deviation: 5.5 ± 1.2 mg/L) compared to the levels in the healthy control participants (copper: 1.00 ± 0.25 mg/L, ferritin: 120 ± 30 ng/mL, CRP: 2.0 ± 0.5 mg/L). In contrast, the zinc and vitamin D levels in the stone mine workers were significantly lower than those in the controls (zinc: 0.90 ± 0.20 mg/L, vitamin D: 30 ± 7 ng/mL), and the CRP and ferritin levels were higher ($p < 0.05$).

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