

## Short Communication

# Selenium levels in patients with schizophrenia

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Accepted 2 August, 2010

**The present study was conducted with serum of twenty four patients of schizophrenia and twenty healthy volunteers; and selenium (Se) levels were determined by atomic absorption spectrophotometer. Serum Se levels were significantly increased in schizophrenia patients as compared to healthy controls. Soil content of Se in Rohtak was found to be lower as compared to Haryana state soil Se levels. These findings suggest that low Se levels in schizophrenia patients and soil may have a role in pathogenesis of schizophrenia.**

**Key words:** Selenium, schizophrenia, geographical distribution.

## INTRODUCTION

Since many factors are included in schizophrenia etiology (genetic, psychologic, biochemical, social, immunologic, etc.), recent studies have implicated role of reactive oxygen (ROS) in the pathogenesis of schizophrenia (Abdalla et al., 1986, 1989; Buckman et al., 1987). Increased SOD activity has been reported in schizophrenia and the results in accumulation of H<sub>2</sub>O<sub>2</sub> removal in the brain were achieved through GSH-Px/GR pathway. H<sub>2</sub>O<sub>2</sub> is an oxidant that is hazardous to neurons (Spina and Cohen, 1988). Selenium (Se) plays an important role in protection against oxidative injury and is an essential constituent of GSH-Px enzyme (Bettger, 1993). Se exerts its effect by catalyzing the destruction-degradation of diffusible ROS, organic hydroperoxides and (or) organic free radicals. Se is an essential component of the daily diet, important for endogenous antioxidant defense system and immunological defense. Inadequate intake of Se is inversely associated with cardiovascular diseases, cancer and other degenerative diseases (Bettger, 1993).

The purpose of our study is to study serum selenium levels in schizophrenia patients, geographic distribution of Se in soil will be compared with that of schizophrenia patients in Haryana (India) and Se theory of schizophrenia will be evaluated.

## MATERIALS AND METHODS

Twenty four patients of schizophrenia (18 males and 6 females), aged 35 - 50 years attending Psychiatry Clinic at Pt.B.D.Sharma PGIMS, Rohtak (India) were included in the study. The diagnosis of schizophrenia was made on clinical criteria. Blood samples were drawn from these patients before starting any treatment. Twenty healthy volunteers served as controls. Serum was separated by centrifugation and determination of Se in serum was performed by acid digestion of the samples followed by reduction of Se to hydrogen selenide which was determined by atomic absorption spectrophotometer (AAS) (in Chemistry Department, MDU, Rohtak). Also, soil content [surface soil (0 - 15 cm) obtained from agricultural fields] of Se in Rohtak district and all the districts of Haryana were determined. From soil samples (2 - 3 kg), after drying and sieving (through 0.360 mm steel mesh), approximately 0.5 g was taken for digestion.

The soil sample was digested slowly by 10 ml nitric acid and 10 ml hydrofluoric acid in teflon beaker in steam bath, dissolved in 6 M HCl and then heated at 80°C to reduce Se. After reduction, solution was diluted to 50 ml by demineralized water and was used for Se determination by AAS. The data so obtained was analyzed statistically using student's t-test.

## RESULTS

Serum Se levels were significantly increased in patients with schizophrenia as compared to healthy controls (Table 1, P < 0.001). The soil content of Se in Haryana was found to be 410 ± 42.5 ppb (or µg/kg) and in Rohtak district it was lower (204 ± 11.2 wg/kg) (range 183 - 215

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**Table 1.** Selenium levels (mean  $\pm$  SD, \*ppb/ml; \*\*ppb ( $\mu$ g/kg).

	Control*	Schizophrenia*	Soil	Soil Haryana
<b>Selenium levels</b>	100.57 $\pm$ 13.45	133.75 $\pm$ 27.50	204 $\pm$ 11.2	410 $\pm$ 42.5

$\mu$ g/kg).

## DISCUSSION

The oxido-reduction equilibrium disturbance is detected in many psychopathological conditions like Down's syndrome, epilepsy, schizophrenia, as well as in neuro-degenerative diseases (Abdalla et al., 1989; Spina and Cohen, 1988; Huret et al., 1987; Nikushkin et al., 1987). Free radicals could initiate functional changes in the brain and many reports suggest that antioxidative defense of the brain is primarily located in the glia and within cerebral capillaries rather than in neurons which make the brain tissue susceptible to oxidative stress (Slivka et al., 1991; Adams and Odunze 1991). Some changes of biochemical parameters in schizophrenia patients (the increase of lipid peroxide, phospholipase A<sub>2</sub>, the amount of transition metals, the decrease of essential fatty acids in the blood plasma, as well as post-mortem findings of increased iron and copper in globus pallidus) are very similar to changes that are caused by oxidative stress (Lohr, 1991). Also, degenerative changes in the central nervous system of schizophrenia patients have been reported to be negatively correlated to GSH-Px activity in the erythrocytes (Buckman et al., 1987). Se is an integral part of Se dependent glutathione peroxidases, a group of water-soluble enzymes that catalyze the destruction of water-soluble and in some cases, membrane-bound hydroperoxides. It has also been reported that Se-dependent GSH-Px activity is decreased in schizophrenia (Abdalla et al., 1986). In contrast, few reports are available where normal Se levels are found in schizophrenia patients (Alertsen et al., 1986). In the present study, we observed low Se levels in schizophrenia patients as compared to controls.

Trace amounts of Se are required in the body to maintain appropriate peroxide level, a level of ROS, organic hydroperoxides and organic free radicals that are compatible with normal cell function, and Se-deficiency signs are often attributable to free radical damage in tissues (Bettger, 1993). Inadequate intake of Se is inversely associated with cardiovascular disease, cancer and other degenerative disease (Bettger, 1993; Diplock, 1991). Selenium content in soil in Haryana State was 410  $\pm$  42.5  $\mu$ g/kg (range 330 - 500) and in Rohtak district it was lower, that is, 204  $\pm$  11.2  $\mu$ g/kg (range 183 - 215). The concentration of Se in food is strongly dependent on the soil concentration and availability in the area of origin

and it is affected by cooking losses. Very large differences exist in the selenium intake of human population in different parts of the world (Diplock, 1993). The ultimate source of selenium for mammalian food chains is the soil (Diplock, 1993). Plasma selenium concentration may be taken as a good index of nutritional status with respect to selenium. These findings suggest that low Se levels in schizophrenic patients may have a role in pathogenesis of schizophrenia.

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