

## STUDY AND ESTIMATION OF CATALASE ENZYME (CAT) LEVELS IN PATIENTS INFECTED WITH THE CORONAVIRUS USING THE ELISA TECHNIQUE

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### Abstract:

Oxidative inhibitors encompass a wide range of entities that conduct an interruption process of the oxidation event employing free radical blockade or elimination. Thus, antioxidants' role is in constantly cleaning active oxygen and nitrogen species out of the organism by not giving them a chance to cause the destruction of living cells. The biochemical process catalyzed by Superoxide Dismutase and Catalase greatly limits oxygen free radicals. The viral infections do most easily develop due to the oxidative processes, as the oxygen free radicals aid virus reproduction. This study measured the level of CAT enzyme in the serum of 50 individuals infected with the coronavirus in two stages: the primary phase of disease (infection) and 10 days later, by way of ELISA device. The results indicate that there is a significant difference ( $P$  value  $< 0.01$ ) between the enzyme concentrations in the studied groups when compared to the control group. Furthermore, the level of the enzyme CAT in the first stage group was lower compared to the second one. According to the study, coronavirus can boost the intracellular level of antioxidants which results in oxidative stress and thus, cellular damages.

**Keywords:** Antioxidants, CAT enzyme, Coronavirus, ELISA.

### Introduction

The effect of oxidative stress on the host resistance to viral infections cannot be underestimated, stimulating viral replication. The oxidative reactions are a foundation upon which viruses grow in the host cells, while through the different ways antioxidants treat a set of diseases related to oxidative stress<sup>[1,2]</sup>. The rapid dissemination of viruses has led to the emergence of new therapeutic pan-pandemic strategies. Many viruses generate metabolic disruptions in infected cells, resulting in reactive oxygen species. Creating interventions by utilizing the natural compounds that possess antioxidant function is an approach against the coronavirus<sup>[3]</sup>. Viral disease has been further complicated by the effect of inhibition of the immune function and stimulation of virus replication. Infections heighten levels of the clusters of inflammatory cells that produce elevated reactive oxygen species and cytokines, which spread and cause lung



damage, as well as escalating the problems. On the common, RNA virus tend to induce changes in the body's antioxidant system resulting in the changes in Superoxide dismutase (SOD) and Catalase (CAT) enzymes and levels of ascorbic acid and carotenoids<sup>[4,5]</sup>.

Enzyme (CAT) is present wherever there is an aerobic respiration and where cells of cytochromes are present. Catalase is crucial for hydrogen peroxide decomposition that is formed in stress and is the second level of cell and tissue plant defense after superoxide/anion dismutation enzymes. The oxidation of hydrogen peroxide to water and oxygen is done by the catalase that is capable of acting as both an oxidiser and a reducer using the hydrogen peroxide. Therefore, it is clear that this enzyme's reaction with hydrogen peroxide initiates the oxidation on one part while the process of reduction occurs on the other part, therefore, the products of the reaction are water and oxygen<sup>[6,7]</sup>.

### Materials and Methods

During this study, blood samples were collected from 50 individuals infected with the coronavirus at the beginning of their infection and upon entering quarantine. The samples were collected from both males and females, smokers, and non-smokers. The control group consisted of 50 individuals who were not infected with the coronavirus. The samples were collected in November 2022, the concentration of the CAT enzyme was estimated using an ELISA device [8].

### Statistical Analysis

The data underwent statistical analysis through ANOVA testing, and the outcomes were presented in tables, including mean values, standard deviations, and a significance level ( $P < 0.01$ ).

### Results and discussion

**Table (1): Comparison of serum concentrations of CAT enzyme (pg/ml) in COVID-19 patients versus the control group.**

Parameter	Mean level in patients(Group A)	Mean level in patients(GroupB)	Mean level in controls	P-Value
(CAT) enzyme	100.3 c ± 21.1	234.7 b ± 36.4	675.4 a ± 41.9	P<0.01

**Table (2): Estimation the activity of CAT enzyme in serum of patients infected with the coronavirus by gender**

Parameter	gender	Mean level in patients(Group A)	Mean level in patients(GroupB)	P-Value
(CAT) enzyme	Male	72.8 c ± 20.40	107.2 d ± 16.18	P<0.01
	Female	84.7 d ± 13.10	243.5 b ± 41.30	



**Table (3): Estimation of the concentration of CAT enzyme in patients infected with the coronavirus serum between smokers and non –smokers**

Parameter	Groups	Mean level in patients(Group A)	Mean level in patients(GroupB)	Mean level in controls	P-Value
(CAT) enzyme	smokers	84.9 c ± 12.0	222.8 b ± 24.6	656.6 a ± 29.4	P<0.01
	non – smokers	131.1 d ± 18.4	225.8 b ± 27.4	700.4 a ± 21.6	

\*Group A = Initial infection.

\*Group B = After 10 days of infection

The similar letters (a, b, c) indicate no significant differences

The results presented in Table (1) indicate the effectiveness of the enzyme catalase (CAT) in the serum of infected individuals compared to the control group. Statistically, significant differences (at a probability level of  $p < 0.01$ ) were observed in CAT activity in the serum of infected individuals compared to the control group. The enzyme level in the serum of infected individuals in Group A ( $100.3 c \pm 21.1$ ) and Group B ( $234.7 b \pm 36.4$ ) was lower compared to the control group ( $675.4 a \pm 41.9$ ). The results show that CAT enzyme activity in the serum of infected individuals in Group A is the lowest compared to Groups B and the control, attributed to the impact of the coronavirus. The virus affects the respiratory system, and one symptom of coronavirus infection is airway secretions, accompanied by increased  $H_2O_2$  secretion. Elevated  $H_2O_2$  secretions in coronavirus infection lead to an increased workload of CAT enzyme in infected cells<sup>[9,10,11]</sup>. Studies have shown that antioxidant enzymes like CAT play a crucial role in reducing infections and strengthening the immune system. Immunity in individuals with chronic infections is often weak, and qualitative immunity is considered one of the most important responses to the virus<sup>[12]</sup>. A study has demonstrated that CAT has the ability to regulate cytokine production in egg cells, protecting cells from oxidative damage, potentially providing an effective therapeutic solution for the pandemic<sup>[10]</sup>. In a study on coronavirus patients, no significant differences were observed between infected individuals and healthy individuals<sup>[13]</sup>, contrary to the findings in the current study.

The results presented in Table (2) revealed the concentration of the enzyme CAT in the serum of male and female individuals infected with the coronavirus in both groups. Statistically, significant differences (at a probability level of  $p < 0.01$ ) were observed in CAT activity in the serum of male and female individuals infected with the coronavirus in both groups. In Group A, the concentration of CAT in males was ( $72.8 c \pm 20.40$ ), and in females, it was ( $84.7 d \pm 13.1$ ). In Group B, the concentration of CAT in males was ( $107.2 d \pm 16.18$ ), and in females, it was ( $243.5 b \pm 41.30$ ). It is noted that the concentration of the CAT enzyme in Group A, for both males and females, is lower than in Group B for both genders. Additionally, in both



groups, the concentration of CAT is higher in females compared to males, attributed to individual habits and their impact on the enzyme levels.

The results shown in Table (3) indicate the concentration of the CAT enzyme in the serum of smokers and non-smokers infected with the coronavirus in both groups. Statistically, significant differences (at a probability level of  $p < 0.01$ ) were observed in CAT activity in the serum of smokers and non-smokers infected with the coronavirus in all three groups. In Group A, the concentration of the enzyme in smokers was  $(84.9 \text{ c} \pm 12.0)$ , and in non-smokers, it was  $(131.1 \text{ d} \pm 18.4)$ . In Group B, the concentration of CAT in smokers was  $(222.8 \text{ b} \pm 24.6)$ , and in non-smokers, it was  $(225.8 \text{ b} \pm 27.4)$ . In the control group, the concentration of the enzyme in smokers was  $(656.6 \text{ a} \pm 29.4)$ , and in non-smokers, it was  $(700.4 \text{ a} \pm 21.6)$ . It is observed that the CAT enzyme concentration in the serum of smokers and non-smokers in Group A is lower than in Group B, while the enzyme concentration is highest in the control group. This is attributed to the damage caused by the coronavirus. The results also indicate that the enzyme level in smokers is lower than in non-smokers, as smoking increases the production of free radicals, depleting CAT enzyme in the human body<sup>[14,15,16]</sup>.

## Conclusion

Coronavirus contributes to the rise in oxidative stress in the body, thus, cells get affected via the consumption of antioxidants. This mostly occurs in this study because the degree of the CAT enzyme in patients with coronavirus is very low. The application of antioxidants might promote a positive effect in neutralizing the effects of oxidative stress that are instigated by the coronavirus infection.

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