

## Evaluation of Superoxide Dismutase (SOD) Enzyme Level and Some Indicators in People Exposed to Smoke

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### Abstract

*The aim of this study is to assess the level of SOD enzyme and its impact in people who are exposed to smoking, in addition to measuring C-reactive protein, and finally measure a complete picture of blood samples taken from patients. The results of the current study showed there is a significant differences ( $p < 0.05$ ) in the activity of the SOD. The mean of SOD activity in patient was 127.9 U/ml while the mean of the enzyme in the control was 96.00 U/ml. CBC and CRP analysis for all (case and control) were investigated, the existence of a relationship between each of them with the level of SOD enzyme due to its relationship with free radicals and due people exposed to smoking their body's efforts to adapt to the constant challenges they face. The results of the current study showed there is a significant differences ( $p < 0.05$ ) of CRP, the mean of CRP in patient was 9.853 mg/dl while the mean of the CRP in the control was 4.917 mg/dl. Our results revealed significant differences ( $p < 0.05$ ) in WBC and P.C.V. The mean of WBC in patient was  $7.41 \times 10^3/\mu\text{L}$  while the mean of the WBC in the control was  $6.98 \times 10^3/\mu\text{L}$  significant high due to the body's immune response to protect the body from the harmful effects*

**Keywords:** SOD. CRP. Smoke. WBC. CBC

### INTRODUCTION

SOD a class of antioxidant type enzymes that catalyze the conversion of superoxide radicals ( $\text{O}_2^-$ ) into molecular oxygen ( $\text{O}_2$ ) and hydrogen peroxide  $\text{H}_2\text{O}_2$  [1].

Superoxide dismutases (SODs) are metalloenzymes found in nearly all eukaryotic and some prokaryotic live cells in the human body., they are localized in the cytoplasm (SOD1) and the mitochondrial intermembrane (SOD2), and extracellular compartment (SOD3) [2].

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These enzymes play a protective role against free radicals to respond to their harmful influences on biomolecules and eventually body tissues based on their reaction to general free radical attack [3].

Numerous studies have highlighted the nutritional and health benefits of antioxidants as well as the inverse correlation between antioxidants and free radicals. It demonstrates that free radicals or reactive species through oxidative stress are involved in the occurrence and development of many health conditions such as atherosclerosis,

diabetes, cancer, neurological disorders, cardiovascular disorders and other chronic conditions [4] The relationship of antioxidants with disease Oxidative stress is an imbalance between the production of ROS and the defense systems to readily detoxify them [5]. In human, oxidative damage and free radicals are associated with a number of diseases [6].

The purpose of the study is to assess the level of this enzyme and its impact in patients who are exposed to smoking, in addition to measuring C-reactive protein, and finally measure a complete picture of blood samples taken from patients.

## MATERIAL AND METHOD

### Sample Collection

This study is conducted at the department of biotechnology, college of applied science/university of Fallujah from July to November 2022. The study included (80) person. A questionnaire was used to obtain detailed information about, age, duration of chronic disease, weight and smoking were reported.

Five ml of blood were collected, samples divided into, two aliquots,: 1 ml of blood, was delivered in a tube containing(EDTA), this is used to measure CBC, whereas the second, aliquot was dispensed in gel tube, and separated, by centrifuge at (3000, rpm) for (10 min) to separate serum.

### Determination of Total Serum Superoxide Dismutase (SOD) Activity

The activity of SOD has determined in serum by indirect method of Beyer which deepened on the indirect method (riboflavin/NBT method) (Beyer & Fridovich.,1987)[7]. This method was based on the principle that superoxide radicals cause the reduction of nitro blue tetrazolium (NBT) to violet formazan, that can be measured at 470-560 nm spectrophotometrically

### Calculations

From the following formula the inhibition percentage of SOD activity was determined:

$$\text{SOD activity (inhibition \%)} = \frac{(\text{AB2}-\text{AB1})-(\text{AS2}-\text{AS1})}{(\text{AB2}-\text{AB1})} \times 100$$

Where:

AS1 = The absorbance of sample before illumination.

AS2 = The absorbance of sample after illumination.

AB1 = The absorbance of blank before illumination.

AB2 = The absorbance of blank after illumination

### Statistical Analysis

Software Prism Graph Pad 8.0.1 was used for statistical analysis. T-test was performed to find significance between the average values of patients and healthy control.

## RESULTS AND DISCUSSION

### SOD Activity

The results of the current study showed there is a significant differences ( $p < 0.05$ ) in the activity of the SOD. The mean of SOD activity in patient was 127.9 U/ml while the mean of the enzyme in the control was 96.00 U/ml (Table 1).

It is possible that the increase in the level of the enzyme is due to its relationship with free radicals, exposure to smoke and pollutants in general (smoke in particular), as exposure to smoke leads to the formation of free radicals. The results showed a relationship between blood SOD activity and smoke causing an increase in the enzyme level for all samples. The association likely may be modified by age, suffers from chronic diseases, and other infections. We found a strong correlation between smoking and SOD level[8]. Antioxidants are chemicals that combat free radicals in the body and stop or lessen the damage caused by free radicals and unstable molecules. Antioxidants play a role in fighting the signs of

aging, and they also have an important role in strengthening the body's immunity [9].

### C-Reactive Protein

The results of the current study showed there is a significant differences ( $p < 0.05$ ) of CRP. The mean of CRP in patient was 9.853 mg/dl while the mean of the CRP in the control was 4.917 mg/dl Table 1.

**Table 1.** Showed relation shape SOD with CRP.

Parameters	Groups	Mean	t-value	95% Confidence Interval	P-value	P-value summary
C-RP (mg/dl)	Control	4.91	7.65	3.62 to 6.23	<0.0001	****
	Patients	9.85	19.61	8.82 to 10.88	<0.0001	****
SOD (IU/ml)	Control	96.00	12.05	79.71 to 112.3	<0.0001	****
	Patients	127.9	8.39	96.78 to 159.10	<0.0001	****

The results was also found that there is a relationship between the SOD elevation and CRP in those who exposed to smoke. Our finding this indicates that high CRP is considered as an indicator of the occurrence of inflammation, and since the enzyme works to remove free radicals, then there is a relationship between high CRP and high SOD.

Our results agrees with Asthana and Asha, *etal* (2010) smoking of cigarette has been related with increases in C-reactive protein (CRP) and WBC counts [10].

### White Blood Cells and P.C.V

The results of the current study showed there is a significant differences ( $p < 0.05$ ) of WBC and P.C.V. The mean of WBC in patient was  $7.41 \times 10^3/\mu\text{L}$  while the mean of the WBC in the control was  $6.98 \times 10^3/\mu\text{L}$ . Table 2

**Table 2.** Hematological Parameters.

Parameters	Groups	Mean	t-value	95% Confidence Interval	P-value	P-value summary
WBCs ( $\times 10^3/\mu\text{L}$ )	Control	6.98	20.09	6.27 to 7.69	<0.0001	****
	Patients	7.41	16.11	6.46 to 8.35	<0.0001	****
HCT (%)	Control	44.90	72.50	43.63 to 46.16	<0.0001	****
	Patients	46.05	52.19	44.25 to 47.85	<0.0001	****

In another research conducted (2019) showed that the number of white blood cells increased in smokers, particularly in those who inhale and in non-smokers[11].

The increase in white blood cells in people exposed to smoke is part of the body's immune response and aims to protect the body from the harmful effects of smoke and pollutants

The results of the current study showed there is a significant differences ( $p < 0.05$ ) of P.C.V. The mean of PCV in patient 46.05 while the mean of the PCV in the control was 44.90. It has been observed that pollutants and smoke affect both hematocrit, hemoglobin and mean corpuscular volume[12]. The current study is agree with several research and reports, increase in RBC counts, PCV, and levels of hemoglobin. These data propose an increase in bone marrow activity to avoid the hypoxia in people who have been exposed to smoke [13].

### CONCLUSION

The results revealed existence of a direct relationship between the SOD enzyme and people exposed

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to smoke. Variation in the ratios of effects in the blood such as WBC, CRP, PCV.

## REFERENCES

1. Saibi, W., & Brini, F. (2018). Superoxide dismutase (SOD) and abiotic stress tolerance in plants: An overview. *Superoxide Dismutase: Structure, Synthesis and Applications; Magliozzi, S., Ed*, 101-142.
2. Fridovich, I. (1972). Superoxide radical and superoxide dismutase. *Accounts of Chemical Research*, 5(10), 321-326.
3. Ighodaro, O. M., & Akinloye, O. A. (2018). First line defence antioxidants-superoxide dismutase (SOD), catalase (CAT) and glutathione peroxidase (GPX): Their fundamental role in the entire antioxidant defence grid. *Alexandria journal of medicine*, 54(4), 287-293.
4. Giustarini, D., Dalle-Donne, I., Tsikas, D., & Rossi, R. (2009). Oxidative stress and human diseases: origin, link, measurement, mechanisms, and biomarkers. *Critical reviews in clinical laboratory sciences*, 46(5-6), 241-281.
5. Valko, M., Leibfritz, D., Moncol, J., Cronin, M. T., Mazur, M., & Telser, J. (2007). Free radicals and antioxidants in normal physiological functions and human disease. *The international journal of biochemistry & cell biology*, 39(1), 44-84..
6. Bagchi, K., & Puri, S. (1998). Free radicals and antioxidants in health and disease: A review. *EMHJ-Eastern Mediterranean Health Journal*, 4 (2), 350-360, 1998..
7. Beyer, Jr WF. Fridovich, I. Assaying for superoxide dismutase activity : some larg consequences of minor changes in conditions. *Analytical biochemistry*. (1998). Mar 1;161(2):559-66
8. Ighodaro, O. M., & Akinloye, O. A. (2018). First line defence antioxidants-superoxide dismutase (SOD), catalase (CAT) and glutathione peroxidase (GPX): Their fundamental role in the entire antioxidant defence grid. *Alexandria journal of medicine*, 54(4), 287-293.
9. Lobo, V., Patil, A., Phatak, A., & Chandra, N. (2010). Free radicals, antioxidants and functional foods: Impact on human health. *Pharmacognosy reviews*, 4(8), 118.
10. Asthana, A., Johnson, H. M., Piper, M. E., Fiore, M. C., Baker, T. B., & Stein, J. H. (2010). Effects of smoking intensity and cessation on inflammatory markers in a large cohort of active smokers. *American heart journal*, 160(3), 458-463
11. Pedersen, K. M., Çolak, Y., Ellervik, C., Hasselbalch, H. C., Bojesen, S. E., & Nordestgaard, B. G. (2019). Smoking and increased white and red blood cells: a mendelian randomization approach in the copenhagen general population study. *Arteriosclerosis, thrombosis, and vascular biology*, 39(5), 965-977.
12. Ramesh, K. S. V., Swetha, P., Kumar, P. M., Sruthima, N. V. S., & Kumar, C. N. (2019). Estimation of superoxide dismutase levels in saliva and gingival crevicular fluid among smokers and non-smokers in periodontitis patients-An Observational Study. *Nigerian Medical Journal*, 60(3), 133-137.
13. Alkhedaide, A. Q. (2020). Tobacco smoking causes secondary polycythemia and a mild leukocytosis among heavy smokers in Taif City in Saudi Arabia. *Saudi journal of biological sciences*, 27(1), 407-411.