The Effect of Chronic Bacterial Prostatitis on Levels Antioxidant in Adult Men: A Meta-Analysis of Case-control Studies

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Abstract. Globally, adult males are frequently affected with chronic bacterial prostatitis (CBP), a prevalent urological illness. It is believed that the inflammatory reaction linked to CBP causes oxidative stress, which may change the impacted people's levels of enzyme antioxidants the Effect of Chronic Bacterial Prostatitis on Levels Enzymatic Antioxidant. From October - 2022 to August - 2023, examined 270 clinical samples from subjects males (adults). Two groups were divided: the first group consisted of 180 male patients. In contrast, the second group consisted of 90 healthy males (adults). Blood samples of (3-5) ml were collected from all participants and the levels of zinc, selenium, glutathione peroxidase GPx, superoxide dismutase SOD, and catalase CAT were measured. The results showed that the levels of zinc, selenium, GPx, SOD, and CAT in men with chronic bacterial prostatitis were significantly lower than those in the control group of patients who were visited after ethical treatment at AL-Sader Medical City in Najaf Governorate. Aspects approved by the Medical Ethics Committee of the Iraqi Ministry of Health. The aim of this meta-analysis is to statistically evaluate and in-depth examine the case-control studies conducted so far regarding the effects of CBP on the levels of enzymatic antioxidants in adult men.

1 Introduction

CP is the common male urological disease that does not have any limitations of age. The results of combined drug therapy in many cases do not lead to satisfactory results despite the progress of modern pharmacology, which often determines primarily low quality of life for such patients [1]. Prostatitis is an inflammation of the prostate gland that causes a number of different symptoms and signs; it can even make a man infertile and greatly influences male infertility — it's quite common among men, especially between 30 and 50 years old [2-5]. Bacterial prostatitis accounts for about 8-16% of all prostatitis cases. It makes this disease a major health problem globally for men.

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Prostatitis is an infection that can cause bacterial inflammation in the prostate gland. Its symptoms include pain or discomfort in the lower pelvic region, frequent urination, and difficulty in urinating. The prostate can develop acute and chronic inflammatory infiltrates which do not always show obvious signs; this imbalance results from the production of reactive oxygen species (ROS) leading to oxidative stress (OS). In turn, OS occurs due to an insufficient cellular antioxidant capacity preventing formation of ROS at a high rate than normal levels.

An antioxidant is described as a chemical substance present in low concentrations compared to the oxidizable substrate, yet it has the ability to substantially impede oxidation of the substrate. Typically, antioxidants are bifurcated into two classes for ease: primary antioxidants which are primary antioxidants; and secondary antioxidants which act as chain breakers and stop cell damage. Preventive antioxidants that impede oxidation are also known as secondary or preventive antioxidants [6,7].

The text was about the biological activities of selenium. Antioxidant selenoproteins in which it is active include glutathione reductase; thus, selenium helps to fight against free radicals as an antioxidant alongside immune function supporting selenoproteins.

A metal of many uses, zinc is essential for numerous metabolic processes. In the human body, zinc constitutes 1.5-2.5 grams in weight, primarily distributed in the skin, skeletal muscle, prostate and retina. While its major role lies in immunity enhancement as an antioxidant and co-factor for over 300 metalloenzymes with cell signaling properties [8-12].

Cell growth disorders and metabolic issues are not only the consequences of an insufficiency of trace elements but also, paradoxically, is an outcome if you have them in excess; cancer and mutations can likewise arise from this situation. However, trace elements can promote immune mechanisms. Changes in trace element ion levels can affect the activity of antioxidant enzymes. Zinc plus selenium make efforts to reduce inflammation and oxidative stress: while enhancing immunity, they induce apoptosis and activate DNA repair genes. Se plays a major role as an essential trace element involved in many physiological processes that maintain human health including host defense mechanisms against infections and cancer surveillance programs. By participating in selenoprotein synthesis along with redox-active amino acids (e.g., selenocysteine), low levels of Se have been shown during severe illness with poor clinical outcomes. An important part of inflammation: it enhances production of prostaglandins — leading to increased pain perception at local sites where there is infection or tumor cells — formation also leads back toward more oxidative stress through other enzymes produced at this site [13]. The supplementation of CoQ10 has shown to be effective in critically ill patients as it targets the major components of severe illness—excessive production of inflammatory cytokines and increased oxidative stress.

2 Patients and method

A case-control hospital-based methodology was used to conduct the study, which included examining 270 clinical samples from subject's males (adults) in total and ran from October - 2022 to August - 2023. The study involved two groups of participants: the first group included 180 male patients, while the second group comprised 90 healthy male subjects who served as controls. 3 to 5 ml of blood were drawn from all individuals, and serum was separated and stored at -20°C until use. The aim of the study was to measure the activity levels of three different enzymes in the blood using a spectrophotometer: the levels of zinc, selenium, glutathione peroxidase GPx, superoxide dismutase SOD enzyme, and catalase CAT enzyme were tested using a spectrophotometer. Taking into account ethical considerations, the study was approved by the Medical Ethics Committee of the Iraqi Ministry of Health.

Inclusion and Exclusion Criteria: Individuals with lower urinary tract symptoms (LUTS), acute, chronic prostatitis, prostate cancer, and chronic epididymitis or orchitis were excluded. Patients with chronic bacterial prostatitis (CBP) were also included.

Ethical Considerations: The Ethics Committee of the Human Research Institution of Sadr Medical City approved the premise of the study. In addition, each participant signed a written informed consent before participating in the study.

Statistical Analysis: One-way ANOVA Mean ± standard deviation (S.df) was used to illustrate the results of the Scheffe method. When comparing patients with healthy subjects, a p value less than 0.05 was considered statistically significant [14].

3 Results

3.1 Evaluation of serum zinc concentrations in patients with chronic bacterial prostatitis and healthy subjects

The results of the current study show that the Zinc concentration in the chronic bacterial prostatitis Serum of patients was (37.66 ±1.755) U/ml and (89.36 ± 1.755) U /ml respectively compared to the healthy group, with high significant differences in p≤ 0,0001, figure (1).

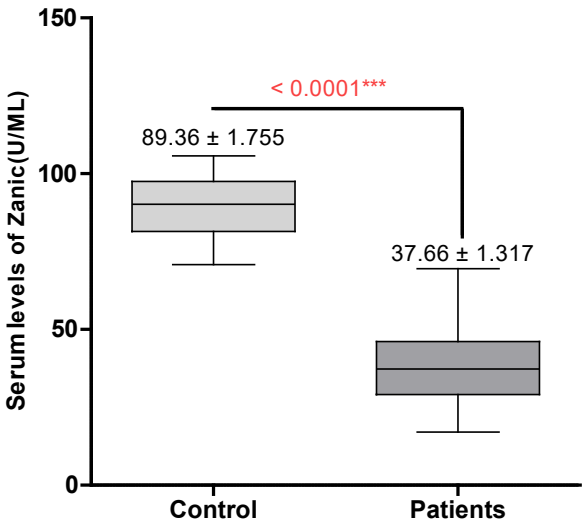

Fig. 1. Serum Zinc concentration in Serum of chronic bacterial prostatitis patients and healthy group.

3.2 Serum selenium content in patients with chronic bacterial prostatitis and healthy controls

The results showed a highly significant decrease (P<0.0001) in the level of Selenium concentration in the Serum of chronic bacterial prostatitis patients (44.14 ± 1.155) ng/ml, as compared with the healthy group (82.15 ± 2.080) ng/ml as shown in Figure (2).

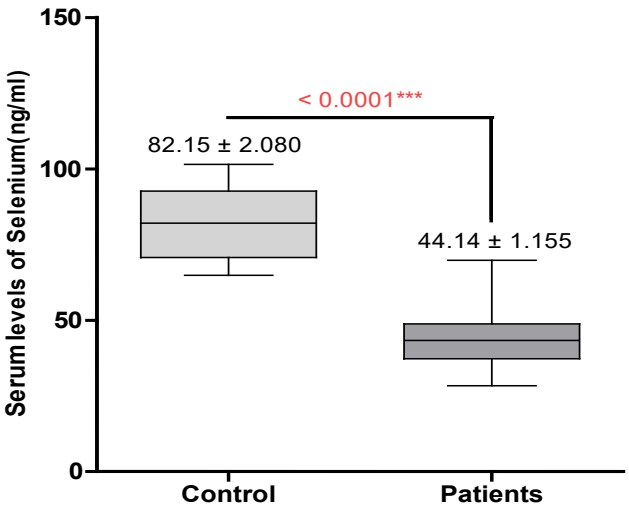

Fig 2. Selenium concentration in Serum of chronic bacterial prostatitis patients compared with the healthy group

3.3 Evaluation of GPX concentration of chronic bacterial prostatitis patients compared with the healthy group

The present study observed that the concentration GPX of (19.85 ± 1.213) U/L in the Serum of chronic bacterial prostatitis patients was highly significant (P-value < 0.0001) as compared healthy group (40.29 ± 0.569) U/L as shown in figure (3).

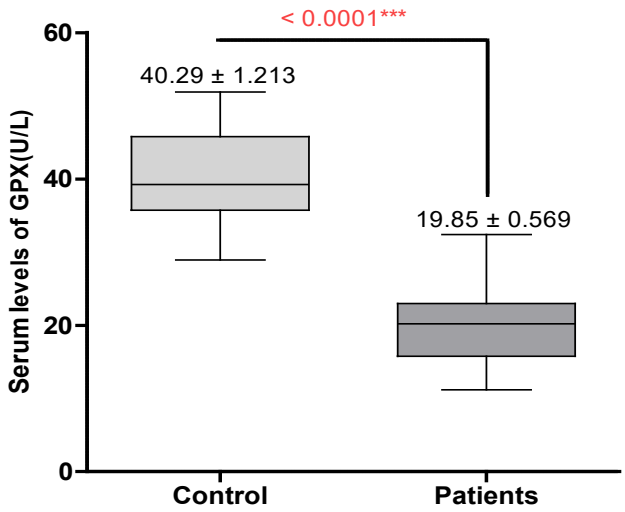

Fig. 3. Levels GPX concentration of chronic bacterial prostatitis patients compared with the healthy group

3.4 Evaluation of SOD of concentration chronic bacterial prostatitis patients compared with the healthy group

The present study also observed that the concentration of SOD concentration in bacterial prostatitis patients (44.16± 1.1014) U/ml decreased high significantly at P-value< 0.0001 than the healthy group (91.44 ± 1.277) U/ml as shown in Figure (4).

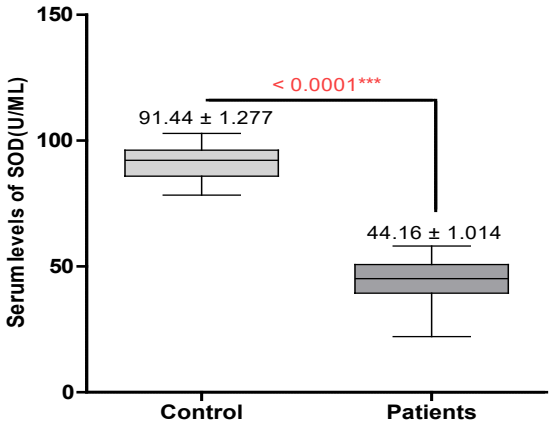

Fig. 4. SOD concentration (U/ml) chronic bacterial prostatitis patients compared with the healthy group

3.5 Total Catalase concentration of chronic bacterial prostatitis patients compared with the healthy group

The present study observed that the concentration of catalase (37.00 ± 1.123) KU/L in bacterial prostatitis patients was significantly high (P-value < 0.0001) as compared to the healthy group (77.71 ± 1.443) KU/L as shown in figure (5).

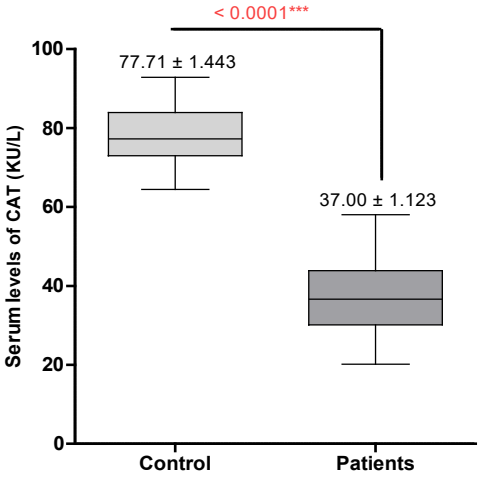

Fig. 5. Catalase Serum concentration (KU/L) of chronic bacterial prostatitis patients compared with the healthy group

4 Discussion

The implication of significantly decreased levels of enzymatic antioxidants in the CBP group underscores a striking inference: oxidative stress may well be a pivotal player in the pathophysiology of chronic bacterial prostatitis. These antioxidants play a role in curtailing oxidative damage, which they achieve by scavenging free radicals and ensuring a delicate redox equilibrium; an imbalance can be deleterious. The finding implies that CBP patients exhibit compromised antioxidant defenses a factor potentiating inflammation and harm to prostatic tissue. A statistical analysis conducted as part of this study revealed distinct variations of zinc, selenium, GPx, SOD, and CAT levels between men afflicted with chronic bacterial prostatitis and those in the control group— with those five components being notably lower among the former set than the latter. Selenium is crucial for supporting optimal immune function (both animals and humans), through various biological systems; its antioxidant actions are orchestrated by GPx that rids cells off potentially harmful lipid hydroperoxides. It must be noted that at least five identified peroxidases work hand in hand with GPx at different cellular levels to ensure effective removal of these agents hence preserving cell integrity and function. Selenium acts as an antioxidant, hence it's vital for cellular health and immunity support: selenoenzymes have anti-inflammatory effects by inhibiting oxidation at a cellular level while diphenyl diselenide an organoselenium compound — exerts anti-inflammatory effects through modulation of macrophage activation and inhibition of NO production. Nanoselenium's antioxidant effects involve enhancing GPx, SOD, and CAT activities as well as direct free radical scavenging due to critical illness defined by oxidative stress that reactive oxygen species play to connect inflammation and another pathway which is discussed above. The findings presented here are in line with a research that demonstrated lower zinc concentrations in prostatic fluid and seminal plasma of chronic prostatitis patients— findings reported from another study cited earlier [15-20]. Sperm motility can be hampered by ROS, inflammatory cytokines, and other factors leading to necrospermia vs. asthenozoospermia distinction; thus, assessment of cell membrane integrity plays vital role in evaluating sperm motility. According to WHO, live sperm percentage monitoring is clinically important as high levels of immotile sperm (above 40%) indicate increased pathological value without detection capacity through standard diagnostics alone. In bacterial infections within male reproductive system areas including prostate case where bacteria release toxins into seminal plasma environment along with leukocytes contributing towards oxidative stress plus other inflammatory factors also further altering this environment: we see impaired sperm motility being promoted. An investigation conducted in 2000 found that the average levels of reactive oxygen species (ROS) and total antioxidant capacity (ROS-TAC score) were significantly higher among healthy men as compared to those suffering from chronic prostatitis. Elevations in ROS levels coupled with reductions in TAC have deleterious effects on sperm chromatin structure as well as sperm plasma membrane. The release of proinflammatory cytokines leads to a cascade that includes high production of nitric oxide free radicals acting competitively with superoxide dismutase towards superoxide anions, resulting in the formation of peroxynitrite along with other reactive nitrogen species. These RNAs, together with NO•-, are highly reactive and intended to destroy pathogens due to their high toxicity after formation via dual action of COX-2 induced because of NF-κB owing to iNOS synthesis involving RNS production through TNF-α and IL-1/IL-6 generation. SOD is a critical element in the body's anti-oxidant defense system which mainly acts against superoxide anions [21-25]. Hence, the variations of oxidative compounds and enzyme antioxidants in the CBP group might have connections with infertility. This aspect will be thoroughly probed in future research investigations.

5 Conclusion

There are findings that suggest oxidative stress and oxidative damage are heightened in patients who have chronic bacterial prostatitis; this increase is closely related to the worsening of the disease. It has been noted from our study that chronic bacterial prostatitis leads to lowered levels of key enzyme antioxidants significantly in adult men which underscores the importance of addressing oxidative stress during treatment of Chronic Bacterial Prostatitis.

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