Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI:10.53555/jptcp.v30i18.5621

EVALUATIVE STUDY OF OXIDATIVE STRESS MARKERS IN THE PATIENTS OF TUBERCULOSIS: A COMPARATIVE STUDY.

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Abstract:
Background: An imbalance in oxidative stress status (OS) may be caused by pulmonary tuberculosis (TB), which is well recognized. In underdeveloped nations, socioeconomic and nutritional status are the primary determinants of tuberculosis (MTB) prevalence, which is the leading cause of mortality on a worldwide scale.
Aim: The purpose of this research was to examine oxidative stress indicators in individuals with pulmonary tuberculosis (PTB).
Methods: The present study was conducted on 50 patients of Tuberculosis and 50 normal healthy individuals. the study was carried out in biochemistry department of Santiniketan medical college Bolpur Birbhum West Bengal. Oxidative stress marker super oxidase dismutase, nitric oxide and serum C-reactive protein were analyzed for both groups. One way ANOVA statistical tool was applied to find out the statistical significance of the study.
Result: In our study we have found increased level of serum CRP and SOD in patients of tuberculosis, and nitric oxide was lower in TB patients as compared to normal subjects.
Conclusion: Our current research shows that oxidative stress is quite prevalent in tuberculosis.

Keywords: Tuberculosis, Oxidative stress marker, Super oxidase dismutase (SOD), C- reactive protein (CRP) and Nitric Oxide (NO).

Introduction:

Pulmonary tuberculosis (PTB) is caused by the mycobacterium tuberculosis. Roughly 10 million individuals fall victim to this infectious illness annually, making it one of the world's most pressing health concerns.[1] The main way it is disseminated is when people with active tuberculosis cough, sneeze, or spit up aerosols from their lungs. The pathogen infects a new host when its droplets are inhaled and enter the air sacs of the lungs. Local alveolar macrophages ingest the bacteria at that

location.[2] Oxidative stress (OS) is caused by an imbalance between free oxygen species that are reactive (ROS) and antioxidant systems [3,4]. The pulmonary system is exposed to 10-15,000 liters of air per day, which includes exogenous oxidative agents such pollution, tobacco smoke, and allergens [5]. During cellular metabolism, the lungs are exposed to basal oxidative stress caused by the production of reactive oxygen species (ROS) such as superoxide anion and hydrogen peroxide (H_2O_2). When exposed to the bacterium, macrophages in pulmonary TB experience a respiratory burst [6]. It's interesting to note that operating systems can have both positive and negative effects, as they operate in a chemical manner without discrimination. While ROS can cause harm to the host's cells, it also has the ability to eliminate infectious agents, such as invading pathogens, that are present within the host[2]. M. tuberculosis infects and replicates inside host macrophages. Infected macrophages begin a respiratory burst and create high quantities of ROS to kill mycobacteria[7].
After mycobacterium infection of the lungs, superoxide dismutase (SOD), which is highly expressed in the lungs, is unable to perform its regular function and produces free radicals either directly or indirectly through the burst of respiration mechanism of macrophages[8,9]. One of the antioxidant proteins called SOD catalyzes the dismutation of superoxide anion into hydrogen peroxide (H_2O_2), which reduces the number of hydroxyl radicals in the environment. Catalase or glutathione peroxidase then converts H_2O_2 into oxygen and water[9]. Since SOD plays a role in scavenging free radicals, particularly superoxide anion radicals, interfering with its activity in the future may cause radicals to spread throughout the body more[8]. Nitric oxide (NO), among all the ROS, is recognized to be one of the primary factors functioning as an anti-TB agent from a mechanistic standpoint. The enzyme NO synthase in macrophages produces NO, and it has been shown that animals lacking NO synthase are more susceptible to M. tuberculosis[10].

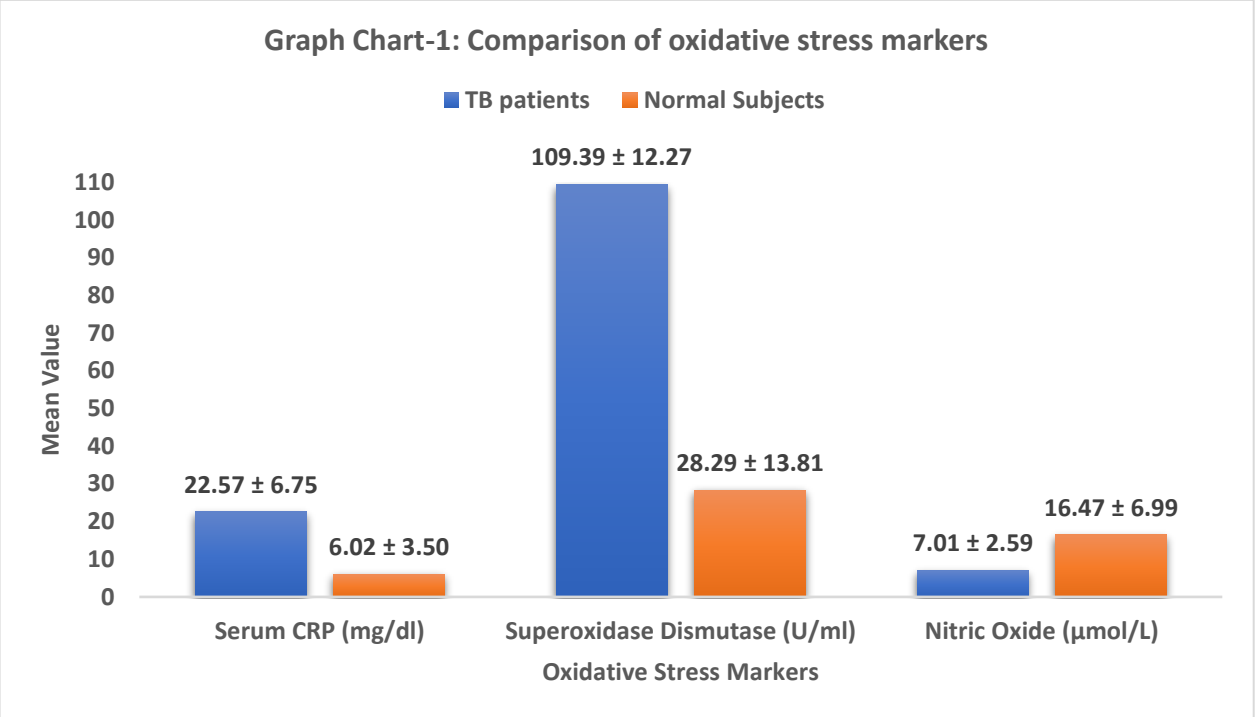
Aim and objectives: The aim of this research was to examine oxidative stress indicators in the individuals with pulmonary tuberculosis (PTB) and healthy subjects.

Methods and Materials:
The study was carried out in the biochemistry department of Santiniketan medical college Bolpur Birbhum West Bengal. 50 patients of Tuberculosis and 50 normal healthy individuals were included in the study-based on inclusion (only pulmonary tuberculosis cases) and exclusion criteria (patients having infection with atypical mycobacteria and mycobacterium leprae). The Oxidative stress marker super oxidase dismutase, nitric oxide and serum C-reactive protein were analyzed for both groups. WST-8 SOD estimation method was used for superoxide dismutase, serum CRP was analyzed by Erba biochemistry analyzer based on colorimetry and fluorescence method was used to analyzed nitric oxide. One way ANOVA statistical tool was applied to find out the statistical significance of the study. The findings were presented as means ± SD. Statistical significance was set at a p-value < 0.05.

Result and observations:
In the study, all the 100 samples were estimated for serum CRP, superoxide dismutase and Nitric oxide. Table 1 and graph chart are showing the comparison of oxidative stress marker (serum CRP, superoxide dismutase and Nitric oxide) in the patients of Tuberculosis and normal healthy individuals.

Oxidative Stress Markers	TB patients (Mean ± SD)	Normal Subjects (Mean ± SD)	p-value
Serum CRP (mg/dl)	22.57 ± 6.75	6.02 ± 3.50	<0.001*
Superoxidase Dismutase (U/ml)	109.39 ± 12.27	28.29 ± 13.81	<0.001*
Nitric Oxide (µmol/L)	7.01 ± 2.59	16.47 ± 6.99	<0.001*

Table-1: Comparison of oxidative stress markers (serum CRP, superoxide dismutase and Nitric oxide) in the patients of Tuberculosis and normal healthy individuals.



Graph Chart-1: Comparison of oxidative stress markers (serum CRP, superoxide dismutase and Nitric oxide) in the patients of Tuberculosis and normal healthy individuals.

In our observations, we had found higher level of serum CRP was 22.57 ± 6.75 mg/dl (mean ± SD) in Tb patients as compared to healthy individuals (6.02 ± 3.50 mg/dl) and mean difference was statistically highly significant (p-value- <0.001). Serum SOD level was 109.39 ± 12.27 U/ml higher and normal in healthy individuals (28.29 ± 13.81 U/ml), which is also statistically significant (p-value- <0.001). Serum nitric oxide level was statistically lower (7.01 ± 2.59 µmol/L) in TB patients and normal in healthy subjects (16.47 ± 6.99 µmol/L), and mean difference of these group was statistically highly significant (p-value- <0.001).

Discussion:

In our study we have found higher level of serum CRP and SOD and lower range of nitric oxide in the subjects of tuberculosis as compared to normal person, which was statistically significant. Chattopadhyay K. D. was observed higher level of SOD in Tb patients before starting treatment, which was statistically significant. and also found low SOD level after treatment of 6 to 12 months[11]. Andreea-Daniela Meca et.al; were found increased level of SOD in the patients of tuberculosis as compared to control group[12]. Qiu-yue LIU et, al; were found statistically raised value of SOD and serum CRP in the subjects of tuberculosis as compared to normal subjects[13]. Chaoqun Qi, Hongjun Wang, Zhaoying Liu & Haibo Yang were found lower level of serum SOD in TB patients after six months of treatment [14]. Jonna Idh et.al; were described low level of serum nitric oxide in TB patients [10]. Batta A. was found significantly lower level of SOD in the subjects of TB as compared to normal subjects[15]. Shreewardhan Haribhau Rajopadhye et.al; were found increased level of serum CRP, which was statistically significant and higher level of SOD in the Tuberculosis group, which was found statistically not significant. In his study, serum nitric oxide level was statistically lower in the patients of tuberculosis[16]. Chul-Su Yang, Jae-Min Yuk and Eun-Kyeong Jo were described that, NO is an important part of killing mycobacteria, but it's not clear if it's also an important part of humans' defense against Mycobacterium tuberculosis. According to his observation serum NO was lower in TB patients as compared to control group [17]. James Brown et.al; were found high concentration of serum CRP level in the patients of Tuberculosis. According to his study, when active tuberculosis (TB) is being investigated or treated, the blood C-reactive protein (CRP) quantity is often checked. [18].

Conclusion:
Based on our study and previous research, there are little bit controversial statement was found about the level of SOD in the subjects of tuberculosis. According to our study serum SOD might be predictable biomarker for the detection of tuberculosis. Serum nitric acid level was decreased in mycobacterium tuberculosis infection. In order to effectively manage this public health concern, future research on TB modulation should investigate biochemical alterations.

Conflict of Interest: Nill

Acknowledgement: We would like to thank principal, teaching staff of Santiniketan medical College Bolpur Birbhum West Bengal, Rohilkhand Medical college and Hospital, Bareilly, Uttar Pradesh and Manipal Tata Medical College, Manipal Academy of Higher Education, Manipal, India.

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