



Lipid Peroxidation And Antioxidants With Lipid Profile In Pulmonary Tuberculosis

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Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

Background: Pulmonary tuberculosis, an infectious disease caused by Mycobacterium tuberculosis, is one of the world's leading causes of death. Several studies have reported that, increased oxidative stress and decreased antioxidant levels are closely related in pathogenesis of pulmonary tuberculosis. This study provides the information oxidative stress, Antioxidant status and serum lipid levels in pulmonary tuberculosis patients.

Aim: The aim of this study is to investigate the Lipid peroxidation, Antioxidant status and Lipid profile in pulmonary tuberculosis

Materials and methods: Thirty newly diagnosed tuberculosis cases and thirty normal healthy subjects in the age group of 20-65 years were enrolled for this study. Lipid peroxidation product, antioxidants and lipid profile were studied in tuberculosis patients.

Result and Discussion: MDA levels were found to be significantly higher and a significant decrease in antioxidants (Albumin, Uric acid, Vitamin C) were seen in tuberculosis patients compared to controls (14.34±7.59 vs 3.30±1.49, 3.36± 0.58 vs 5.34±0.29, 4.6±1.55 vs 5.1±0.76, 0.14±0.13 vs 0.86±0.41 respectively). This indicates that increased generation of ROS in tuberculosis patients uses up the plasma antioxidants and still aggravates the tissue damage. Due to increased lipid peroxidation, significant decreases in lipid levels were observed in tuberculosis patients. The decrease in antioxidant levels with increased oxidative stress may be the cause for the pathogenesis of lung tissue damage observed in tuberculosis.

Conclusion: It was concluded from the above observation that there is increase oxidative stress in pulmonary tuberculosis, which is indicated by the raised serum malondialdehyde level. The lipids level was found to be decreased which can be related to increased lipid Peroxidation.

Increased oxidative stress and low antioxidants level which indicate the antioxidants were completely utilized to scavenge the free radicals.

Keywords: Lipid Peroxidation, Pulmonary Tuberculosis , Antioxidants.

Introduction

Pulmonary tuberculosis, an infectious disease caused by Mycobacterium tuberculosis, is one of the world's leading causes of death.^{1,2} Other predisposing factors that may cause tuberculosis include poor

nutrition, underprivileged living conditions, poor hygiene, along with history of exposure to tuberculosis patients.³ It primarily affects the lungs, intestine, meninges, bones, joints, lymph glands and skin.⁴ India accounts for nearly one-third of global

burden of tuberculosis. Every year, approximately 1.8 million persons develop tuberculosis of which about 0.8 million are new smear positive and highly infectious cases and about 4.17 lakhs die every year.⁵ It is a multifactorial disease and it also includes the effects of oxidative stress. Recent studies showed that there is an increase in several circulating markers of free radical activity, indicating ongoing oxidative stress and decrease in the antioxidant activity which may contribute to development of lung function abnormalities in pulmonary tuberculosis.⁶ Increase in circulating free radical level and an imbalance between oxidants & antioxidants is seen in these patients.^{7,8} Free radicals causes lipid peroxidation mostly in cell membrane leading to cell damage. Malondialdehyde is the major product formed from lipid peroxidation.⁹

Antioxidants are physiologic substances that are derived from both endogenous and exogenous sources and act to quench ROS. They are divided into two groups namely enzymatic antioxidants & non enzymatic antioxidants. Example of enzymatic antioxidants includes catalase, superoxide dismutase, glutathione peroxidase. Example of non enzymatic antioxidants includes vitamin C, vitamin E, albumin, uric acid and β -carotene. Increase in free radical generation can cause damage to the host, but the severity of damage can be compromised by antioxidants. Low level of antioxidants can cause cell damage.¹⁰

To our knowledge not much research has been reported regarding the oxidative stress and role of antioxidants in pulmonary tuberculosis in south India. Some studies have shown that antioxidant supplementation along with anti-tuberculosis therapy is useful to reduce oxidative stress in patients with tuberculosis.¹¹ Hence, this study was undertaken to evaluate the levels of oxidative stress, antioxidants and lipid profile in pulmonary tuberculosis patients in our hospital.

Aim:

The aim of this study is to investigate the Lipid peroxidation, Antioxidant status and Lipid profile in pulmonary tuberculosis patients

Objectives:

To compare the oxidative stress and antioxidant levels among the pulmonary tuberculosis cases and controls.

To compare the lipid profile among the pulmonary tuberculosis cases and controls.

Materials And Methods:

This study was a hospital based case control study conducted over a period of six months in the Department of Biochemistry in collaboration with the Department of Pulmonary Medicine at Sri Manakula Vinayagar Medical College and Hospital, Puducherry. 3 milliliters (fasting sample) of venous blood was collected from the patients. Serum was separated and immediate parameters were analyzed, and remaining serum was stored at -20°C for further analysis. A written consent for sample collection was obtained as per the procedure. This study was formally approved by the Institute Research Council and Institute Human Ethics Committee.

Study Design: Case – control study

Sample Size:

1. Cases: 30
2. Controls: 30

Inclusion Criteria:

Newly diagnosed pulmonary tuberculosis patients whose sputum was positive for tubercle bacilli.

Exclusion Criteria:

1. Smokers
2. Other Lung disorders
3. Known HIV cases

Result:**Table 1: Comparison of lipid parameters between tuberculosis cases and controls.**

Parameter	Cases	Controls
	(n=30)	(n=30)
TC (mg/dl)	139± 27.14	163.87± 23.08*
TG (mg/dl)	87.13±40.80	92.66± 37.12
HDL (mg/dl)	37.46± 6.72	43.56±5.79 *
LDL (mg/dl)	83.90± 23.96	102±20.15*
VLDL (mg/dl)	17.53± 8.14	18.76± 7.50

Table 1: Shows the serum level of Total cholesterol, triglyceride, HDL, LDL and VLDL in patients with pulmonary tuberculosis and healthy controls. Serum levels of those parameter were significantly decreased in subjects with pulmonary tuberculosis when compared to controls.

Table 2: Comparison of oxidants and antioxidants level in tuberculosis cases and controls

Parameters	Cases	Controls
	(n=30)	(n=30)
MDA (µmol/L)	14.34± 7.59	3.30±1.49*
Albumin (g/l)	3.36± 0.58	5.34±0.29*
Uric Acid (mg/dl)	4.6±1.55	5.1±0.76
Vitamin C (mg/dl)	0.14±0.13	0.86±0.41*

Table 2: Shows the comparison between oxidants and antioxidants levels in pulmonary tuberculosis patients with controls. The level of serum MDA was found to be significantly increased in tuberculosis patients and the

antioxidants (Albumin, Vitamin C) levels was significantly decreased in cases than in controls. There was no significant difference ($p > 0.05$) in the uric acid level in subjects when compared to controls.

Discussion:

Pulmonary tuberculosis is a global public health problem with an estimated rate of 2 million deaths per year.⁸⁶ Mycobacteria are intracellular pathogens which induce reactive oxygen species to cause respiratory burst. In the present study, we have evaluated the lipid peroxidation product (MDA), antioxidants status (Albumin, Uric acid and Vitamins C) and lipid profile in pulmonary tuberculosis patients. Our study showed that the oxidative stress parameter, MDA, was significantly increased in pulmonary tuberculosis patients and a significant decrease in serum antioxidants (Albumin Vitamin C, Uric acid) was observed among the cases.

A study done by Kwiatkowska *et al*, showed an increase in MDA level in pulmonary tuberculosis patients when compared to normal healthy controls.⁴⁹ Reddy *et al* and Tesfaye *et al*, also found that concentration of lipid peroxidation product, MDA was significantly higher in tuberculosis patients.⁸⁷ Madebo *et al*, reported a significant increase in the concentration of MDA and decreased Vitamin C level in newly diagnosed tuberculosis patients compared to healthy controls.⁵¹ Similar result was shown by Jack *et al*, whose tuberculosis cases had a higher free radical activity when compared to controls. The present study corroborates with the results of previous studies and MDA was found to cause host tissue damage such as lung fibrosis and lung dysfunction in patients with pulmonary tuberculosis.¹⁰

Some studies have reported a significant decrease in albumin level in tuberculosis patients.^{88,89} Kowalski *et al*, also studied that plasma antioxidant activity was low in pulmonary tuberculosis patients.⁹⁰ Albumin is a negative acute phase protein whose plasma value lowers during infection, injury or stress possibly as a result of increased metabolic need for tissue repair and free radical neutralization.⁷⁰ Our result have shown a significantly lower serum albumin concentration in tuberculosis patients when compared with healthy controls. Decrease in serum albumin concentration in tuberculosis patients might have been the result of anorexia, poor appetite, malnutrition and mal-absorption commonly observed among them. The lower level of albumin may

therefore be one of the complications associated with pulmonary tuberculosis.⁷⁰

Reduced level of Vitamin C have been reported in pulmonary tuberculosis patients in a study done by Awotedu *et al*.⁶⁷ Ascorbic acid is the first antioxidant to be depleted upon exposure to both the environmental and inflammatory oxidants, thus suggesting that it is the ultimate antioxidant to act against the oxidants, either by directly scavenging them or trapping their intermediates.⁵² It plays a major role in pulmonary antioxidant defense. Sufficient amounts of ascorbic acid are necessary to maintain normal metabolic function in the lung.⁹¹

Our study showed that there is a significant decrease in the level of serum vitamin C in pulmonary tuberculosis patients compared to healthy controls. Hence our result agrees with the previous studies.⁴⁷

High MDA concentrations and low levels of non enzymatic antioxidants like vitamin C and albumin may indicate the depletion of antioxidants due to excessive utilization by ROS in pulmonary tuberculosis patients compared to controls. This study also shows, a decrease in serum concentration of uric acid in pulmonary tuberculosis subject when compared to healthy controls, which is however not statistically significant.

The study conducted by Reddy Y.N *et al*, reports that, pulmonary tuberculosis patients have lower TC, TG, HDL and LDL levels than controls.⁹² A decrease in the levels of TC, TG, HDLC, LDLC and VLDL was observed in our study which agrees with the previous study.^{49,92}

It may be due to the increased lipid peroxidation observed in the TB patients. This might have caused reduced serum lipid concentration which has been observed in our study. Triglycerides and LDL cholesterol are the chief constituents of cell membranes while the HDL cholesterol protects the arterial walls of the blood circulatory system. Lower levels of lipids noticed in these patients could be a factor that predisposes them to cell and tissue damage, cardiovascular problems and low cellular immunity.

Conclusion:

This study provides the information about the oxidant and antioxidant status and serum lipid levels in pulmonary tuberculosis patients. Circulating levels of MDA was found to be elevated and non enzymatic antioxidants such as albumin, vitamin C levels were decreased in pulmonary tuberculosis patients when compared to healthy controls.

Our result also showed that increase in the level of MDA reduces the lipid levels in tuberculosis patients. The TB patients had insufficient amount of Antioxidants to cope up with the increased oxidative stress in them. This suggests that Anti-oxidants supplementation along with anti tuberculosis treatment may help in the fast recovery of patients with pulmonary tuberculosis.

Limitations:

In this study, the sample size of tuberculosis cases group was 30. Large sample sizes are likely to reflect more significant changes in the parameters studied.

Estimation of total antioxidant and total oxidant status could have been done.

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