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Analysis of Standard Biochemical Parameters in *Mycobacterium Tuberculosis* - *Infected* Patients in the Doda Region of India

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Abstract: ***Background: This experimental work was performed to analyze the effect of TB in patients suffering from the ailment. This constituent study was carried out in the Doda region of India. This study aims to correlate the conventional biochemical serum markers with tuberculosis infection. Method: The study was performed on a total of 240study participants, consisting of 120TB cases and 120 controls. TB patients' mean age (SD) was 45.53±10.27years and healthy controls were39.09±11.58 years. The assay of the study was to evaluate the concentration of serum glutamate oxaloacetate transaminase (SGOT), serum glutamate pyruvate transaminase (SGPT), Zinc, CRP, and ESR levels in TB patients of the Doda region, attending OPD and Medicine department of Government medical college Doda, J&K UT. Result: The results revealed an increase in crucial biochemical enzymes and inflammation markers of the liver i. e. SGOT (40%), SGPT (34%), ESR (71%), and CRP (78%) levels in patients with tuberculosis compared to health groups. Furthermore, the result also documented a decrease in Zinc (53%), levels in patients suffering from tuberculosis compared to healthy groups. Conclusion: Our results concluded that there was a decrease in Zn^{2+} levels, and an increase in the levels of SGOT, SGPT, ESR & CRP in MTB patients with pulmonary tuberculosis compared to the control group, which is an indication of inflammation of, and liver damage among MTB patients.***

Keywords: TB, SGOT, SGPT, CRP and ESR

1. Introduction

Pulmonary tuberculosis is one of the most common infections and chronic diseases caused by the bacterium *Mycobacterium tuberculosis*, affecting various parts of the body (**1).** MTB primarily targets the lungs and is one of the reasons for the mortality of about 2 million people around the world annually, particularly those who are already infected with HIV and are capable of transmitting the disease to healthy individuals (**2).**

If we have to control TB dexterously, appropriate identification and proper cure of the patients with infectious tuberculosis should be done (**3).** Furthermore, monitoring TB patients is important during treatment to formulate treatment outcomes (**4).** Patients with active tuberculosis produce excessive cytokines like interferon - γ, interleukin (IL) - 1, IL - 2, and tumor necrosis factor - α because of the activation of the immune system. These cytokines raise acute phase proteins of hepatic synthesis like C - reactive protein (CRP) and erythrocyte sedimentation rate (ESR). Besides routine sputum for AFB (acid - fast bacilli), CRP and ESR are used in diagnosis and patients' follow - up procedure who were earlier diagnosed with tuberculosis (**5).** Some conditions like wasting and malnutrition are associated with TB. It is also found that malnutrition and tuberculosis are the major problems in developing nations. Patients with active tuberculosis have significantly lower nutritional status in comparison to the healthy controls. Protein deficiency and malnutrition are the reasons for the increased risk of developing tuberculosis (**6, 7).** The deficiency of essential micronutrients like zinc is known to weaken the immune system, which leads to increased sensitivity to MTB infections (**8, 9).** There are various types of activities in the body in which Zinc is involved, such as wound healing, metabolic function, and immunity (**10).** The normal adult range of serum glutamate pyruvate transaminase (SGPT) is 7 - 35 IU/L, which increases significantly in severe liver damage by the overdose of acetaminophen or viral hepatitis. Enzyme serum glutamate oxaloacetate transaminase (SGOT) which has a normal adult range of 5 - 40 IU/L is associated with liver parenchymal cells mainly found in muscles, liver, kidneys, heart, and pancreas and in the liver and heart (**11).** CRP and ESR levels may also get increased in many infectious diseases like tuberculosis. The present study was designed to investigate the effect of the disease tuberculosis in patients on biochemical and microbiological parameters as MTB targets important organs of the body.

2. Materials and methods

2.1. Subjects

The study was carried out in Government Medical Doda in Jammu division, India. A total of 240 subjects were selected and divided into two study groups, of which 120 were the patients' group and 120 were the control group. The mean (SD) age of the MTB patients was 46.41±13.04 years and that of controls was 34.06±12.98 years.

Inclusion criteria, the patient's group is selected according to the disease and age.

Exclusion criteria, patients who are less or more than the selected age group and patients with other chest diseases are excluded from our study. Informed written consent was obtained from all participants and the study was approved by the member secretary, IEC GMC Doda.

2.2. Sample collection

Sterilized 5ml syringes were used for drawing blood from the vein and two types of tubes were used for sample collection. One is a red top which contains clot activator used for all investigations except ESR. The second type of tube contains sodium citrate as an anticoagulant to prevent blood from clotting and is used for Westergren erythrocyte sedimentation rate determination (ESR). After taking the blood, samples were kept undisturbed for 10 minutes at room temperature for clotting, followed by centrifuging at 6000 rpm for 10 minutes to separate serum and stored at - 80°C until used for laboratory investigations (**28).**

2.3. Biochemical and Microbiological parameters

2.3.1. Measurements of SGOT and SGPT levels
These were done using a semi - automatic Random - access clinical analyzer and the medicon kinetic method.

Methodology: SGOT and SGPT

An amino group's transfer occurs from L - aspartate to α - ketoglutarate catalyzed by SGOT (AST). And Malate dehydrogenase (MDH) a coupling enzyme, monitors the reaction rate, through which NADH oxaloacetate formed was converted to Malate. The measurement of NADH oxidation was done by monitoring the decrease in absorbance at 340nm (**12).** The reversible transfer of an amino group from alanine to oxoglutarate catalyzed by SGPT (ALT) forms glutamate and pyruvate. Where LDH and NADH reduce pyruvate to lactate (**12).**

2.3.2. Zinc and CRP estimation
Zinc estimation was done by the atomic absorption spectrophotometric method and CRP estimation was done by the turbidimetric method.

Methodology: Zinc and CRP
In an aqueous medium, pyridine - 2 - aldehyde - 2 - pyridyl hydrazine (PAPHY) in a +2 - oxidation state, forms a stable cationic bis complex with zinc. The charged complexes obtain neutrality when the pH of the medium moves to the alkaline side and can be extracted quantitatively into an organic solvent. So, the metal zinc is free of the intrusive effects of the constituents of the serum and is estimated easily by atomic absorption spectrometry (**13).** C - reactive protein can bind with phospholipids (mainly phosphocholine) in the presence of calcium ions, and the CRP - phospholipids complexes formed were measured by turbidimetry method **(14).**

2.3.3. Hematologic analysis
The hematologic analysis of (ESR) was carried out by the Westergren method.

ESR measurement method
In the Westergren method, a standardized upright elongated tube is used to measure the distance (in millimeters) at which red blood cells in anticoagulated whole blood fall to the bottom due to the effect of gravity over one hour. The tube used for the test is called the Westergren tube (**15).**

Statistical Analysis
All the collected data were represented as mean standard deviation. The data analysis for association was processed using a statistical package for the social science software (SPSS 20.0, IBM).

3. Results and Discussion

Each group of the study can be recognized by analyzing different characteristics of the subject's anthropometric characteristics, socio - demographic profile, and biochemical parameters.

Anthropometric characteristics of the study group
The Anthropometric characteristics of240 subjects, including 120 MTB cases and 120 healthy controls have been summarized in Table 1. The mean (SD) age of MTB patients was 46.41±13.04 years and that of controls was 36.06±12.98 years.

Table 1: Anthropometric characteristics of the study group

Variables	Patient (n= 120) Mean± SD	Controls (n=120) Mean± SD
Age (Years)	45.53±10.27	39.09±11.58
Sex (M/F)	66/54	70/50

Socio - demographic profile of the study group
The social class scale of our study is based on residence, smoking, and education (Table 2). This shows that 24.16% of the MTB patients were urban and 75.83% belong to the rural population, while among healthy controls, 28.33% were urban and 71.66% were rural.25% of the MTB patients were smokers and 75% were non - smokers, while among healthy controls 18.33% were smokers and 81.66% were non - smokers. Approximately 45% of the MTB patients were literate and 55 % were illiterate, while among healthy controls 78.33% were literate and 21.66% were illiterate. As earlier discussed by Modawe and his co - workers in Biochemical parameters in relation to tuberculosis (**28)** and Samiaa H. and his co - workers in inflammatory mediators in PTB (**16).**

Table 2: Socio - demographic characteristics of the study group

Variables	Type	Patients n= 150	Percentage	Controls n=150	Percentage
Residence	Urban	29	24.16%	34	28.33%
	Rural	91	75.83%	86	71.66%
Smoking	Smoker	30	25%	22	18.33%
	Non - Smoker	90	75%	98	81.66%
Education	Literate	54	45%	94	78.33%
	Illiterate	68	55%	19	21.66%

Biochemicaland Microbiological Parameters
Biochemical and microbiological analysis of the collected samples was carried out to monitor any variations in the values of the parameters which have been used in the diagnosis of liver damage and follow - up procedures of patients with tuberculosis.

Analysis of the biochemicaland Microbiological parameters of the study group
Each group of studies can be assessed by biochemical diagnosis. As shown in Table 3, the mean of biochemical

and microbiological investigation in this study reported a (P<0.05) decrease in Zn level while the study also reported increased SGOT, SGPT, CRP&ESRlevels in patients with pulmonary tuberculosis compared to the healthy group.

Table 3: Biochemical and microbiological characteristics in the study group

Variables (mean ± SD)	Patient (n= 150)	Controls (n=150)	P value
(AFB)	++	- ve	0.000*
SGOT	38.29±7.63	21.66±5.17	0.049*
SGPT	34.42±5.62	20.76±4.73	0.054*
CRP (mg/dl)	0.84±0.22	0.26±0.13	0.001*
ESR	66.81±10.78	20.26 ± 7.67	0.001*
Serum zinc (µmol/L)	54.01±0.22	82.00±0.16	0.001*

*Data are presented means ± SD. P value < 0.05 is statistically increased. SGOT: serum glutamic oxaloacetic transaminase; SGPT: serum glutamic pyruvic transaminase; ESR: erythrocyte sedimentation rate; CRP: C - reactive protein.

Tuberculosis is a common infectious disease that has affected as many as world's one - third of the total population and there is a continuous increase in new cases as the population increases. The present study consisted of the adult population of the Doda region with tuberculosis (aged 15 - 70 years) and a control group containing healthy individuals matched for age and gender. The anthropometric characteristics of 240 subjects included 120 MTB cases and 120 healthy controls. The mean age of patients was 45.53±10.27years and that of controls was 39.09±11.58years. Our study's social class scale is based on residence, smoking, lifestyle, and education. The mean ages of both cases and controls were compared, and predominantly individuals between34 - 50 years of age were mainly affected which is in agreement with the results of Highman and his co - workers (**17),** Ekweani and his co - workers (**18),** Ali and his co - workers (**19),** and Idigbe and his co - workers (**20).** Our study shows that about 80% of the affected individuals were below 50 years of age, and when we compare this with the reports from developed countries where the majority of the infected population was more than 50 years of age **(28).** The results being reported here are in agreement with the results of the study conducted by Ekweani and his co - workers (**18),** who reported that most of the participating TB patients aged less than 50 years of age.

Each group of studies was recognized by biochemical and microbiological diagnosis. The biochemical and microbiological investigation of our study showed a decrease in the mean values of zinc levels (P<0.05) **(21, 22),** which is agreed by Ali Abdul - Ameer and his co - workers (Add no. of reference), whose results showed a significant decrease in Zn level. The possible causes for the low level of zinc in TB patients may be nutritional factors, enteropathies, and acute phase reactant proteins **(8, 10).** The level of zinc observed among TB patients was lower than the controls, in agreement with a study by Karyadi and his co - workers (**8),** Modawe and his co - workers (**28),** and Taneja and his co - workers (**10)** which showed the reduction in their zinc levels. Also, this was likely due to the reduction of the hepatic production of metallothionein, a protein that transports zinc to the liver as per the results of Gabay and his co - workers 1999 (**29).** While there was an increase in SGOT, SGPT (**23, 24),** ESR (**21),** &CRP (**25),** levels which are statistically increased in patients with pulmonary tuberculosis compared to healthy groups and these results are in agreement with the study of Sri Anggarini Rasyid and his co - workers (**24),** H Rajesh and co - workers (Add reference no.), and Sahin *and his co - workers (***26).** There was a significant increase in the SGOT, SGPT, ESR, and CRP levels in MTB patients as compared to controls which indicates inflammation of the liver in MTB patients. The results are in agreement with the studies of I WayanAgus Putra and his co - workers (**27),** H Rajesh and his co - workers 2020 **(25),** and Sahin and his co - workers, 2012 (**26).** In this study, the zinc level was reduced in patients with TB compared to healthy control.

4. Conclusion

Our results conclude that there was a decrease in Zn levels (54.01±0.22), andan increase in SGOT (38.29±7.63), SGPT (34.42±5.62), ESR (66.81±10.78) & CRP (0.84±0.22) levels in MTB patients with pulmonary tuberculosis compared to the healthy control group, which is an indication of inflammation in the liver among MTB patients. Since the majority of our study participants belonged to lower socioeconomic status, the presence of inherent risk factors like nutritional status could also have influenced the results of our study. Moreover, social risk factors including smoking and alcohol were high in the cases. The biological plausibility of an association between these risk factors and the Biochemical and microbiological profiles could give deeper insights into the clinical prevention and management of the Biochemical risk factors. Our study calls for a prospective analysis of the Biochemical profiles concerning the management of tuberculosis to derive candid guidelines for clinical case management.

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Conflict of interest
None

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