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# ASSOCIATION OF PULMONARY INFECTIONS OF *MYCOBACTERIUM TUBERCULOSIS* WITH BIOCHEMICAL AND DEMOGRAPHIC PARAMETERS

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**ABSTRACT:** *Mycobacterium tuberculosis* infection on the biochemical and demographic parameters of the TB patients were compared with that of the healthy population of local population. Blood samples were collected from healthy and TB patients at chest ward DHQ Hospital Faisalabad after taking informed consent from patients. The study was ethically approved by graduate / ethical committee. Demographic data and biochemical parameters were determined in all patients and healthy volunteers. Results were compared at 95% confidence interval. The patients with pulmonary tuberculosis triggered decreased BMI and low concentration of glucose, total cholesterol, albumin and globulin while higher concentrations of creatinine and an increased activity of alkaline phosphatase, SGPT and SGOT in blood. There seen a number of parameters that differs in diseased patients compared to normal individuals that results in poor health status. Because of less availability of oxygen to the patients in the presence of oxygen competitor *Mycobacterium Tuberculosis,* creation of anaerobic environment may increase concentration of creatinine in the blood of patients.

**KEYWORDS:** Tuberculosis, Creatinine, Biochemical parameters, *Mycobacterium tuberculosis*

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## 1.INTRODUCTION

After a long time tuberculosis is spreading once again in developing countries causing major health problem (Nnodim, et al., 2011). *Mycobacterium Tuberculosis* is an extremely contagious, slow growing, airborne, Gram-positive, rod-shaped, aerobic and acid-fast bacillus. The cell wall of *Mycobacterium tuberculosis* is enriched with lipids and permits the mycobacterium to stay alive in macrophages and make the mycobacterium resistant against many drugs (Katzung, 2011), (Williams and Lemake, 2002), (Amin, 2006), (Rafiq, 2010).The chief host for *Mycobacterium Tuberculosis* contagion is man. Infection is broadcasted through spread of aerosolized bacteria of 1–5 μm in diameter that carry *Mycobacterium Tuberculosis* droplets inhaled by a healthy person. These droplets are choked-up in alveoli in the distal airways. Macrophages present in alveoli then capture the *Mycobacterium Tuberculosis* initiating a flow of measures resulting in either victorious control of the infection or expansion to active disease (Frieden et al., 2003). The cell wall allows the bacteria to survive within macrophages because it has high lipid content (Katzung, 2011), (Williams and Lemake, 2002). Poor health due to malnutrition is observed in most TB patients, compared with the controls previously (Tappero, et al., 2005), (Tsukaguchi, et al., 1991). The disease-induced production of certain cytokines such as interleukin-6 and tumor necrosis factor-$\alpha$ produced during tuberculosis may induce fever, hepatic synthesis of acute phase reactant proteins, inhibit production of serum albumin and plasma concentrations of some important micronutrients are changed dramatically (Beisel, 1998). As can be expected in any chronic granulomatous inflammation, the hyper-gammaglobulinaemia may be due to the immunological response. Most of the patients had higher levels of ESR, which decreased significantly in patients becoming negative for acid-fast bacilli. However ESR is not a diagnostically discerning feature (Escreet and Cowie, 1983). The useful indices for the severity of the TB disease are body weight, platelet count,white cell count and haemoglobin level. If these indices return to normal this is good indication for the control of the disease in that they are associated with sputum conversion to acid-fast bacilli negative (Karyadi et al., 2000) In contrast with the controls, tuberculosis patients has considerably lower body mass index (American Thoracic Society, 2000) and a significantly high ($p< 0.05$) count of total white blood cells. Erythrocyte sedimentation rate (ESR) was assessed at selected intervals of chemotherapy. A gradual reduction in ESR was observed till 365th day of treatment (Saroja, 2013).

## 2. MATERIALS AND METHODS

The biochemical parameters and demographic data were determined among male, healthy and pulmonary TB patients. The clinical part of the study was conducted under the supervision of senior physician and registrar of the chest ward DHQ Hospital Faisalabad Professor Dr Muhammad Sadiq and was assisted by the staff Rozina.

**Subjects**: The studies were designed to be conducted evaluated and documented according to the principles of good clinical practice (GCP), keeping in view the national legal requirements, the ICH Harmonized Tripartite guidelines GCP23 and the ethical principles laid down in the Declaration of Helsinki (WHO, 2008/1996). The healthy volunteers for this study were the students of University of Agriculture, Faisalabad, while patient volunteers were arranged from chest ward District Head Quarters Hospital, Faisalabad, Pakistan. Subjects were eligible to participate if they were more than 18 years of age and were determined to be in good health as assessed by history, physical examination and laboratory studies. Individuals were excluded if they had donated blood within 30 days prior to the study. Each volunteer was apprised of the design of the study and sampling protocol. The volunteers who willingly offered to participate in the study were included in the study and were offered to fill and sign informed consent forms. The study was approved from GSRP (Directorate of graduate studies and research board) / ethical committee. The age, body weight, height, blood pressure and body temperature of both normal and patient volunteers were recorded and presented in fig: 1 and 2 respectively. Body mass index (BMI) was calculated as body weight divided by height squared ($kg/m^2$). Subjects were regarded as being malnourished if BMI < 18.5 $kg/m^2$ (James et al., 1988).

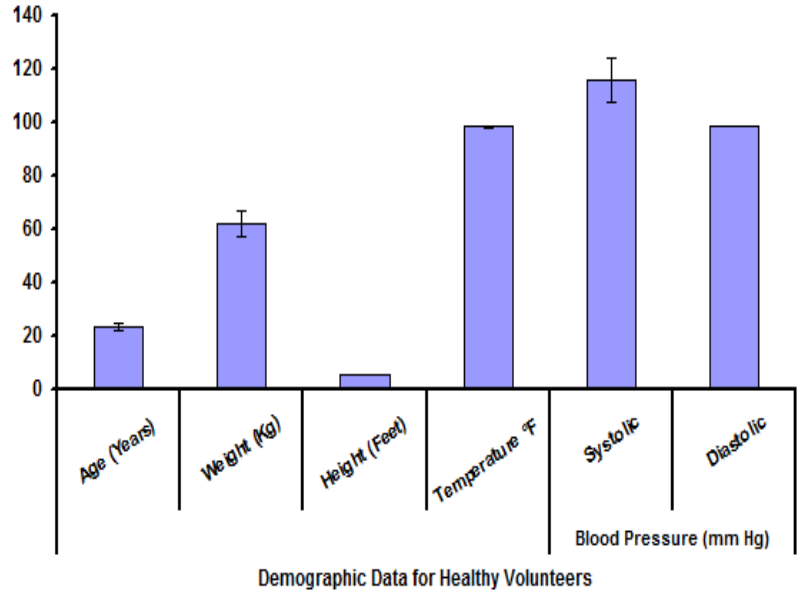


Fig: 1. Mean ±SD values for Demographic Data of Healthy Volunteers.

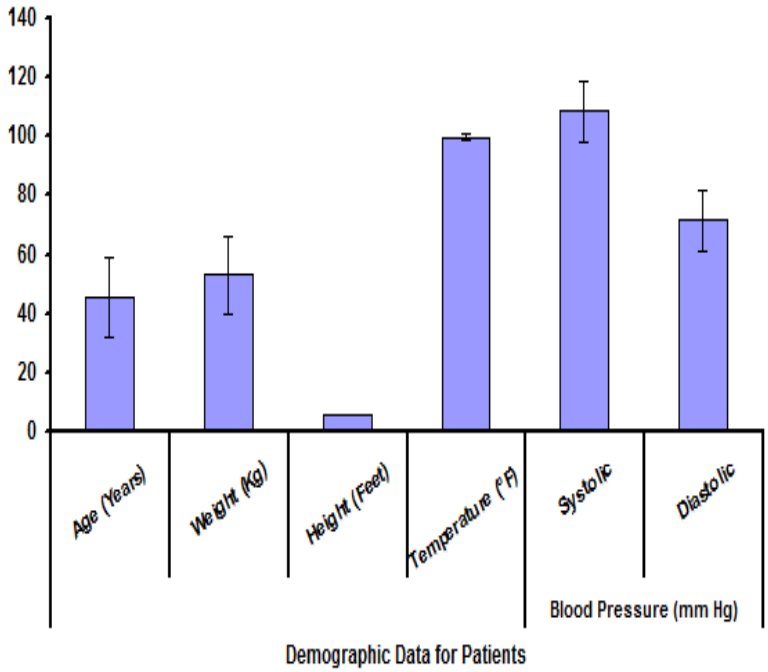


Fig: 2. Mean ±SD values for Demographic Data of Patient Volunteers.

**Biochemical parameters**

The blank sample of blood of each volunteer was collected after fasting of 12 hours, for the determination of biochemical parameters. The biochemical parameters were determined by kit methods, Glucose by FLUITEST, blirubin by DIALAB, SGOT and Alkaline phosphatase by Breuer and Breuer Diagnostic, Albumin and SGPT by GIESSE diagnostic, Cholesterol by Diagnostic System International, Total protein and haemoglobin by Boehringer, Total leucocytes count, neutrophils, Lymphocytes, RBC,s Eosinophils and Monocytes by DIALAB.

**Statistical Calculations**

The mean values and standard deviation (SD) for each parameter were calculated and the results have been presented in tables and graphs using Microsoft excel version 2002. Comparisons of the patient and healthy volunteer parameters were carried out with the help of t-test. (Steel et al., 2006)

## 3. RESULTS AND DISCUSSION

There is an intricate relationship between the virulence of infectious agent and response of host, which adjust the overall metabolic status and the extent and pattern of tissue loss (Paton and Newton, 1999). The nutritional status as evaluated by measuring BMI and serum albumin was significantly ($P<0.05$) lowered in patients (18.3 Kg/m2, 3.46 mg/dL) with pulmonary tuberculosis compared to healthy controls (24.82 Kg/m2, 5.96 mg/dL) in our studies (Table: 1), and other studies carried out in India

England and Japan (Onwubalili, 1989), (Saha and Rao, 1989), (Tsukaguchi, 1991), (Amin 2006). The poorer nutritional status of patients with pulmonary TB may be due to anorexia (Hopewell, 1994) impaired absorption of nutrients or increased catabolism.

Table. 1 Biochemical parameters of pulmonary TB subjects on therapy and healthy volunteers. *P<0.05=Statistically Significant

| Parameters | Patients (Pulmonary TB) | Healthy volunteers | P-value |
|---|---|---|---|
| Hemoglobin | 10.21 | 14.13 | P<0.05 |
| Lymphocytes % | 42.2 | 26.3 | P<0.05 |
| Monocytes % | 1.76 | 0.94 | P<0.05 |
| TLC/cmm | 9592 | 9100 | P<0.05 |
| Eosinophils % | 2.9 | 1.2 | P<0.05 |
| Neutrophils | 53.07 | 70.6 | P<0.05 |
| Albumin mg/dL | 3.46 | 5.98 | P<0.05 |
| Alkaline phosphatase U/L | 202.08 | 154.3 | P<0.05 |
| SGPT U/L | 40.69 | 27.2 | P<0.05 |
| SGOT U/L | 30.07 | 21.3 | P<0.05 |
| Total Protein mg/dL | 5.99 | 7.18 | P<0.05 |
| Creatinine mg/dL | 1.44 | 0.96 | P<0.05 |
| globulin mg/dL | 2.68 | 1.2 | P<0.05 |
| Bilirubin mg/dL | 6.7 | 0.838 | P<0.05 |
| Blood Urea mg/dL | 43.15 | 29.23 | P<0.05 |
| Cholesterol mg/dL | 89 | 141 | P<0.05 |
| Glucose mg/dL | 98 | 66 | P<0.05 |
| BMI Kg/m2 | 18.3 | 24.82 | P<0.05 |

The results of Tappero et al., are consistent with our studies where a significantly (P<0.05) lower BMI and malnutrition in TB patients than controls was observed (. The levels of lymphocytes, monocytes, TLC and eosinophils were low significantly in healthy volunteers (26.3%, 0.94%, 9100/cmm and 1.2% respectively) than patients (42.2%, 1.76%, 9592/cmm and 2.9%) whereas the neutrophils have significantly (P< 0.05) higher values in healthy controls (70.6%) than TB patients (53.07%). The white cell count is useful index for the severity of the TB disease (Yaranal et al., 2013) The significantly (P<0.05) high concentrations of creatinine in the plasma of pulmonary TB patients compared to healthy volunteers, may indicate the use of creatinine phosphate for energy source as the *Mycobacterium Tuberculosis* is the aerobic microorganism and in pulmonary tuberculosis it competes for oxygen available for the host, so the host metabolism may switch from aerobic

metabolism to anaerobic mode (breakdown of creatinine phosphate to produce energy resulting in higher levels of creatinine in the blood) for its energy needs under low oxygen concentrations. Concentrations of blood haemoglobin were lower in malnourished TB patients (10.21g/dL) than in well-nourished healthy controls (14.13 g/dL) and significantly ($P<0.05$) more patients were anaemic (Table: 1). Low haemoglobin concentrations, have also been reported in patients with pulmonary TB previously (Saha and Rao, 1989; Hussain, 2006; Tappero, 2005; Pan, 2011). A low level of Haemoglobin was also observed in TB patients in India by Saroja and Usha where the haemoglobin levels of the selected patients were 8.5, 8.7, 8.8 and 9.0 g/dl in boys, girls, men and women respectively (Saroja, 2003). The concentrations of total protein and albumin were observed to be lower in TB patients compared to normal populations in our studies. It is observed that with the progression of the disease the concentration of the total protein and albumin decreases (Lahlou, 2013), (Saroja, 2003), (Manaddhar, 2002). The levels of globulin (2.68 mg/dL), bilirubin (6.7 mg/dL) and blood urea (43.15 mg/dL) have increased values in patients, and relatively decreased values (globulin 1.2 mg/dL, bilirubin 0.838 mg/dL and blood urea 29.23 mg/dL) in healthy controls respectively (Table: 1). Our results are also consistent with studies conducted in Nigeria where the level of biochemical parameters were measured and compared with controls it was found that the mean levels of globulin was significantly ($P<0.05$) high in pulmonary tuberculosis patients when compared with controls (Akiibinu et al., 2007). The concentrations of the total cholesterol in patients (89 mg/dL) were significantly ($P<0.05$) less in our studies compared to the healthy controls (141 mg/dL). It was found previously that mean levels of total cholesterol (100.7 mg/dL), HDL cholesterol (28.6 mg/dL), LDL cholesterol (65.5+15.1mg/dl) and triglycerides (61.6+16.2mg/dl) were significantly ($P<0.05$) low in patients, when compared with controls (total cholesterol = 163.2+40.1mg/dl; HDL cholesterol = 41.4+5.4mg/dl; LDL cholesterol = 107.8+27.5mg/dl; globulin= 3.4+0.6g/dl ) (Lahlou, 2013). It is a well-known fact that cholesterol is used in the presence of UV light for the production of vitamin D. The addition of vitamin D to infected macrophages augments their ability to kill *M. tuberculosis* (Vyas, 1968). The vulnerability to the disease in patients may be due to the decreased cholesterol levels. The height of the patients in our studies remains fairly constant i-e 4.5 ft. while the height of the healthy volunteers ranges from 5.3-5.10 ft (Fig: 1& 2). We conclude that mycobacterium tuberculosis may have suspended at certain specific levels in the atmosphere.

## 4. CONCLUSION

1. The nutritional status of patients with active pulmonary TB was poor compared to the healthy volunteers as indicated by significantly lowered levels of albumin, hemoglobin and BMI.
2. The significantly ($P<0.05$) high concentrations of creatinine in the plasma of pulmonary TB patients compared to healthy volunteers, may indicate breakdown of creatinine phosphate (to meet the energy needs of the host), as the Mycobacterium Tuberculosis is the aerobic

microorganism and in pulmonary tuberculosis it may competes for oxygen available for the host, so the host metabolism may switch from aerobic metabolism to anaerobic metabolism of breakdown of creatinine phosphate as in the case of extensive exercise.

3. The vulnerability to the disease in patients may be due to the decreased cholesterol levels. It is well established fact that in the presence of UV light cholesterol is converted to vitamin D and the addition of vitamin D to infected macrophages augments their ability to kill M. tuberculosis (Akiibinu et al., 2007; Rockett et al., 1998).
4. The height of the patients in our studies remains fairly constant i-e 4.5 ft. while the height of the healthy volunteers ranges from 5.3-5.10 ft. We conclude that mycobacterium tuberculosis may have suspended at certain specific levels in the atmosphere.

**CONFLICT OF INTEREST**

The authors have no conflict of interest.

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