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**Research Article**

# Comparative Assessment of Liver Function Parameters among Untreated Leprosy and Controls in Pakistan

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**ABSTRACT**
Leprosy is a long-lasting infectious disease that mainly impacts the skin and peripheral nerves, although it can also involve other systems. Given the liver's key roles in metabolism, detoxification, and maintaining biochemical homeostasis, evaluating liver function could yield valuable insights into potential hepatic involvement in leprosy. As a disease progresses or as treatment is administered, liver profile abnormalities may take on clinical significance. To compare selected liver profile parameters, including total bilirubin, direct bilirubin, SGPT (ALT), SGOT (AST), alkaline phosphatase (ALP), and Gamma-GT, in untreated leprosy patients versus healthy controls. A comparative study involving 186 participants was carried out, consisting of 110 untreated leprosy cases and 76 healthy controls. Standard biochemical methods were used to measure the serum liver profile parameters. For each parameter, mean values and standard deviations were computed, and statistical assessments were conducted to determine the differences between the two groups. A p-value of less than 0.05 was deemed statistically significant. In untreated leprosy cases, the average total bilirubin was 0.54 ± 0.12 mg/dL, while in the control group it was 0.53 ± 0.10 mg/dL (p = 0.566). Die Werte für direktes Bilirubin lagen bei 0,13 ± 0,02 und 0,12 ± 0,19 mg/dL (p = 0,102). In cases, the mean SGPT was 27.2 ± 5.17 U/L, whereas in controls it was 28.6 ± 6.19 U/L (p = 0.142). For SGOT, the values were 27.2 ± 4.58 U/L in cases and 28.7 ± 5.67 U/L in controls (p = 0.078). Likewise, ALP levels were 202.2 ± 30.52 U/L in cases and 208.0 ± 33.30 U/L in controls (p = 0.229), while Gamma-GT levels were 22.9 ± 4.69 U/L and 24.5 ± 7.75 U/L, respectively (p = 0.124). All of the assessed parameters exhibited no statistically significant difference between the groups. The results show that the liver biochemical profiles of untreated leprosy patients and healthy individuals are broadly comparable. Even though the mean values of SGPT, SGOT, ALP, and Gamma-GT were somewhat lower in leprosy cases, these differences did not reach statistical significance. The lack of major changes indicates that untreated leprosy was not linked to obvious biochemical hepatic dysfunction in this study population. There was no connection between untreated leprosy and significant changes in serum liver profile parameters. The levels of bilirubin, transaminases, ALP, and Gamma-GT were similar to those of healthy controls, indicating that there was no significant biochemical evidence of hepatic dysfunction in the untreated cases examined.

**Keywords:** Leprosy, Liver Profile, Bilirubin; SGPT, SGOT, Alkaline Phosphatase.

## INTRODUCTION

Leprosy, also known as Hansen's disease, is a long-lasting infectious disease primarily caused by Mycobacterium leprae and, in rare instances, by Mycobacterium lepromatosis. Both are acid-fast bacilli that exhibit very slow growth, with an incubation period that may extend up to five years (Bernardes et al., 2017; Chen et al.,

2022). According to a report by the World Health Organization (WHO), there were about 200,000 new cases of leprosy globally in 2017 (Maymone et al., 2020). About 80% of these cases happened in three countries: India, Brazil, and Indonesia. According to Dharmawan et al. (2023), Indonesia's National Leprosy Control Program documented 10,976 new cases in 2021, resulting in a prevalence rate of 0.43 per 10,000 individuals. Leprosy's clinical manifestation is largely determined by the immune response of the host. According to the WHO, leprosy is classified into two primary categories based on the bacterial load: paucibacillary (PB), characterized by a small number of bacteria and less severe symptoms, and multibacillary (MB), which is associated with a greater bacterial load and more serious disease (Oo et al., 2020; Rodrigues & Lockwood, 2011). Even though leprosy was considered to have been eliminated as a public health problem worldwide in 2000 (characterized as a disease burden of fewer than 1 case per 10,000 individuals), it remains a global public health concern (Shaikh, G. S ET AL., 2025).

Even though leprosy was deemed to have been eradicated as a public health issue globally in 2000 (with a disease burden of fewer than 1 case per 10,000 people), it continues to be a global public health concern (Shaikh, G. S et al.,2026) Bei MB-Patienten weisen die Läsionen üblicherweise mit Lipiden angereicherte Makrophagen auf, die als Schaum- oder Virchow-Zellen bekannt sind. It has been shown in earlier studies that Virchow cells located in the dermal lesions of MB patients exhibit a strong positivity for adipose differentiation-related protein (ADRP), which is a well-known marker of cellular organelles called lipid droplets (Mattos et al., 2010). The findings suggested that the accumulation of these organelles is responsible for at least part of the foamy phenotype observed in Virchow cells. Research involving nerve biopsies from MB patients and in vitro cultures infected with M. leprae demonstrated that Schwann cells, alongside macrophages, exhibited a significant number of lipid droplets (Mattos et al., 2010, 2011). Additionally, M. leprae induces the accumulation of lipid droplets, thereby promoting its own survival (Mattos et al., 2011, 2014). Most of the lipids found in these organelles come from the human host, aligning with the findings of Cruz et al. (2008), who noted an increased expression of genes related to lipid metabolism and synthesis in the skin lesions of MB patients. The significant function of host-derived lipids and lipid droplets in the pathogenesis of M. leprae is underscored by these findings (Cruz et al., 2008; Mattos et al., 2010, 2011, 2014; Sakurai & Skinsnes, 1970).

## MATERIAL AND METHOD

### Sample Collection

Leprosy patients, both treated and untreated, were gathered from the leprosy center (National Training Centre) in Karachi. This study included a total of 220 leprosy cases, comprising 110 untreated newly diagnosed patients and 110 treated leprosy patients. Skin smear tests for diagnostic purposes were conducted, both clinically and based on bacterial analysis. Control samples were collected from the general population for comparison.

### Collection of Blood Samples

After a 14-hour overnight fast, blood samples were taken from patients who met the inclusion criteria. Approximately 5 ml of blood was drawn from the antecubital vein following all aseptic procedures and collected in gel tubes for the lipid profile. After centrifugation for 10 minutes at 3000 rpm, serum was collected and kept at -80°C until analysis.

### Estimation of Lipid Profile, Liver Enzymes and Complete Blood Count

Serum samples from leprosy patients were collected to estimate LFTs using the kits method. Cholesterol was examined using the CHOD-PAP technique. ALT and AST were determined using IFCC, and A Phosphatase was measured by Deutsche Gesellschaft fur Kinische Chemie.

### Statistical Analysis

The data were analyzed using SPSS version 19. Clinical characteristics were summarized using mean ± S.D. for quantitative/continuous variables, including bilirubin, ALT, AST, Alk. Phosphatase, and gamma GT. For the comparison between cases (leprosy untreated/treated group) and controls, Student t-test/ANOVA were employed. Only p-values of less than 0.05 will be regarded as significant in the statistical evaluation.

## RESULT

This study assessed selected liver profile parameters in untreated leprosy patients compared to healthy controls in order to evaluate potential biochemical changes linked to leprosy. The analysis included a total of 186

participants: 110 untreated leprosy cases and 76 healthy controls. The results are shown comparatively with descriptive statistics such as mean and standard deviation, in addition to testing for statistical significance. The results for total bilirubin, direct bilirubin, SGPT, SGOT, ALP, and Gamma-GT are shown in the subsequent tables and figures.

Table 1: Comparison of Liver Function Test Parameters between Untreated Leprosy Cases and Healthy Controls

| Complete Blood Picture | Leprosy Cases (Untreated) (n=110) | Controls (n=76) | P-value |
|---|---|---|---|
| | Mean ± S.D | Mean ± S.D | |
| Bilirubin T (mg %) | 0.54 ± 0.12 | 0.53 ± 0.10 | 0.566 |
| Bilirubin D (mg %) | 0.13 ± 0.02 | 0.12 ± 0.19 | 0.102 |
| SGPT (U/L) | 27.2 ± 5.17 | 28.6 ± 6.19 | 0.142 |
| SGOT (U/L) | 27.2 ± 4.58 | 28.7 ± 5.67 | 0.078 |
| Alkaline Phosphatase (U/L) | 202.2 ± 30.52 | 208.0 ± 33.30 | 0.229 |
| Gamma GT (U/L) | 22.9 ± 4.69 | 24.5 ± 7.75 | 0.124 |

** Statistically Significant ( p<0.01)

In Table 1, liver profile parameters are compared between 110 cases of untreated leprosy and 76 healthy controls. In leprosy cases, the mean total bilirubin level (0.54 ± 0.12 mg/dL) was slightly higher than that of controls (0.53 ± 0.10 mg/dL), but this difference did not reach statistical significance (p = 0.566). In a similar fashion, the levels of direct bilirubin were found to be comparable in both groups (0.13 ± 0.02 vs. 0.12 ± 0.19 mg/dL; p = 0.102). In untreated leprosy cases, the average SGPT level was 27.2 ± 5.17 U/L, while in controls it was 28.6 ± 6.19 U/L (p = 0.142). The SGOT levels were 27.2 ± 4.58 U/L and 28.7 ± 5.67 U/L, respectively (p = 0.078). Both enzymes exhibited mean values that were slightly lower in leprosy cases; however, these differences did not reach statistical significance. In the same way, the cases had an alkaline phosphatase level of 202.2 ± 30.52 U/L, while the controls had a level of 208.0 ± 33.30 U/L (p = 0.229). The Gamma-GT levels were 22.9 ± 4.69 U/L in cases and 24.5 ± 7.75 U/L in controls (p = 0.124). In general, there were no significant differences (p > 0.05) in liver profile parameters between untreated leprosy cases and controls. The results indicate that in this study, untreated leprosy did not correlate with significant biochemical indicators of hepatic dysfunction, as levels of bilirubin, transaminases, alkaline phosphatase, and Gamma-GT were generally comparable to those of healthy controls.

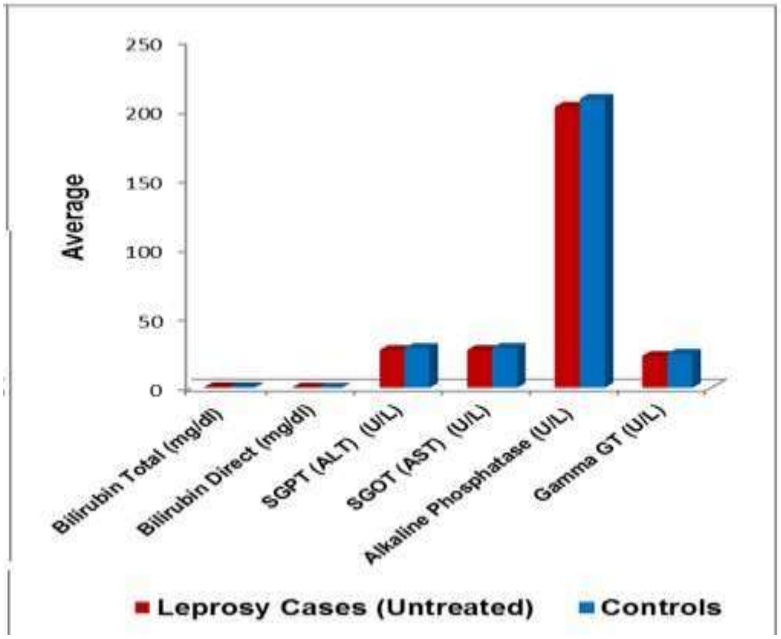


Figure 1: Comparison of Liver Function Test Parameters between Untreated Leprosy Cases and Controls

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The figure provides a graphical comparison of average liver profile parameters between untreated leprosy cases (n = 110) and healthy controls (n = 76). In general, the bars for both groups are closely comparable for all measured parameters. The average total bilirubin levels in untreated leprosy cases and controls were nearly the same, at about 0.54 and 0.53 mg/dL, respectively. In the same way, the groups differed only slightly in terms of direct bilirubin. Among leprosy cases, the average SGPT (ALT) level was 27.2 U/L, which was slightly lower than the control level of 28.6 U/L. Similarly, the SGOT (AST) level in cases was 27.2 U/L, compared to 28.7 U/L in controls. In the case of alkaline phosphatase, the average value was 202.2 U/L for untreated leprosy cases, while it was 208.0 U/L for controls. Leprosy cases also exhibited a slightly lower Gamma-GT level (22.9 U/L) compared to controls (24.5 U/L). The liver profile parameters were generally comparable between untreated leprosy patients and healthy controls, as shown in the figure. The observed slight differences, especially the lower mean levels of SGPT, SGOT, alkaline phosphatase, and Gamma-GT in leprosy cases, were not statistically significant. This graphical finding aligns with the statistical analysis shown in Table 1, where all p-values exceeded 0.05. The findings suggest that there was no substantial connection between untreated leprosy and changes in the liver biochemical parameters assessed in the study population.

## DISCUSSION

Leprosy, as noted by Barua et al. (2021) and Fischer (2017), is a persistent granulomatous infection that mainly impacts the skin, peripheral nerves, and various other organs. The immune response of the host largely determines the clinical course and manifestations of the disease (Fischer, 2017). Leprosy is categorized into six forms according to the Ridley–Jopling classification, based on clinical, histopathological, and immunological criteria (Kumar & Dogra, 2017; Salgado et al., 2019; Alinda et al., 2020). Borderline leprosy exists on a continuum between the polar tuberculoid and polar lepromatous forms. Borderline disease is characterized by the presence of features from both forms in the same patient, illustrating the immunological instability typical of this group (Kumar & Dogra, 2017). Although leprosy can manifest at any age, it is most commonly reported in young adults, especially those in the 20–30 year age range. It is reported that men are generally more affected than women, with a male-to-female ratio of approximately 2:1 (Walker et al., 2013; Ilyas, 2019; Abideen et al., 2021; Hacker et al., 2021). The current investigation found no statistically significant differences in liver profile parameters between 110 untreated leprosy patients and 76 healthy controls. Levels of total and direct bilirubin, SGPT, SGOT, alkaline phosphatase, and Gamma-GT were similar across groups ($p > 0.05$), suggesting that there was no significant biochemical evidence of hepatocellular or cholestatic dysfunction in untreated leprosy patients. The minor variations noted in bilirubin and liver enzymes were minimal and probably represent normal biological fluctuation rather than liver damage associated with disease. As the participants had not received treatment, these results mainly demonstrate the impact of leprosy itself, rather than the hepatotoxicity caused by antileprosy drugs. Nevertheless, normal serum liver enzyme levels do not rule out the possibility of subclinical hepatic involvement. Where clinically indicated, further assessment using synthetic function markers, imaging, and histopathology may offer a more comprehensive evaluation of hepatic involvement in leprosy.

## CONCLUSION

The current investigation showed that there were no significant differences in serum liver profile parameters between untreated leprosy patients and healthy controls. The levels of total and direct bilirubin, SGPT, SGOT, ALP, and Gamma-GT were similar across the groups. The results imply that there was no link between untreated leprosy and clinically apparent biochemical hepatic dysfunction in the study population.

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